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ABSTRACT

Determining which brand of a product is the best buy for a specific use is the challenge of this Unified Sciences and Mathematics for Elementary Schools (USMES) unit. The challenge is general enough to apply to many problem-solving situations in mathematics, science, social science, and language arts at any elementary school level (grades 1-8). The Teacher Resource Book for the unit is divided into five sections. Section I describes the USMES approach to student-initiated investigations of real problems, including a discussion of the nature of USMES "challenges." Section II provides an overview of possible student activities with comments on prerequisite skills, instructional strategies, suggestions when using the unit with primary grades, a flow chart illustrating how investigations evolve from students' discussions of consumer research problems, and a hypothetical account of intermediate-level class activities. Section III provides documented events of actual class activities from grades 2, 4, and 5/6. Section IV includes lists of "How To" cards and background papers, bibliography of non-USMES materials, and a glossary. Section V consists of charts identifying skills, concepts, processes, and areas of study learned as students become involved with consumer research activities. (JN)

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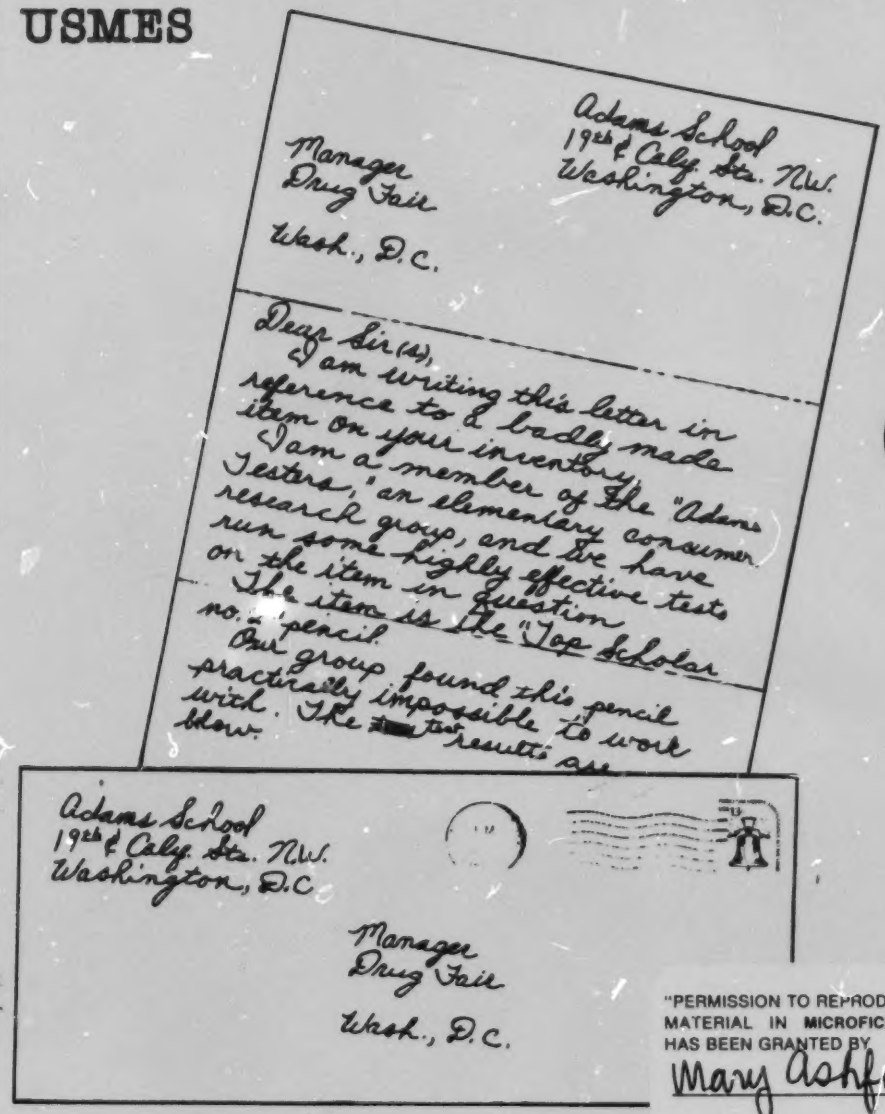
USMES



Adams School
19th & Calf. Sts. NW.
Washington, D.C.

Manager
Drug Fair

Wash., D.C.

Dear Sir(s),

I am writing this letter in reference to a badly made item on your inventory. I am a member of the "Adams Testers," an elementary consumer research group, and we have run some highly effective tests on the item in question. The item is the "Top Scholar" no. 2 pencil.

Our group found this pencil practically impossible to work with. The results are below.

Adams School
19th & Calf. Sts. NW.
Washington, D.C.

Manager
Drug Fair

Wash., D.C.

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Consumer Research

ATTENTION SOGGY CEREAL EATERS

Tired of starting each day with soggy cereal? Then this is for you!

Our USMES group has been studying various cereals in our Consumer Research Unit. Here is what we found:

1. Sullivans Super Value is cheaper than Brooks and Kenny's Supermarkets.
2. Sullivans has more cereals to choose from and a large variety of sizes.
3. Frosted Flakes soaked up the least amount of milk while Wheaties soaked up the next least amount of milk. Grape Nuts soaked up every last drop!

If you have any questions about our research, please feel free to ask us.

David, John, Sheri, Dean, Jamie, Debbie, Deanna, Chrissy

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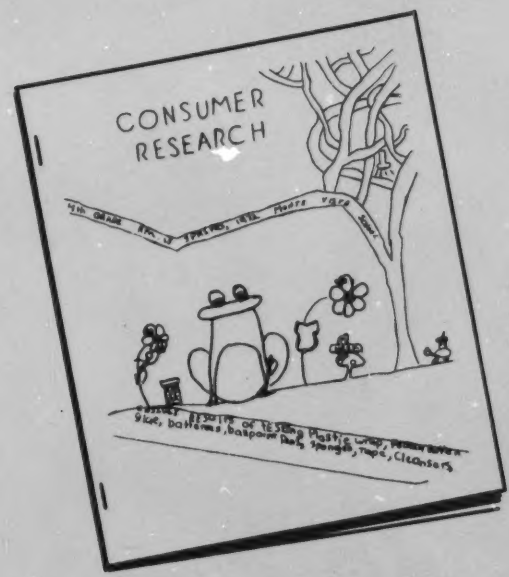
UNIFIED SCIENCES AND MATHEMATICS FOR ELEMENTARY SCHOOLS:
Mathematics and the Natural, Social, and Communications Sciences in Real Problem Solving.

Consumer Research

Fourth Edition



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CHALLENGE: DETERMINE WHICH BRAND OF A PRODUCT IS THE BEST BUY FOR A SPECIFIC USE.

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Preface

The USMES Project

Unified Sciences and Mathematics for Elementary Schools: Mathematics and the Natural, Social, and Communications Sciences in Real Problem Solving (USMES) was formed in response to the recommendations of the 1967 Cambridge Conference on the Correlation of Science and Mathematics in the Schools.* Since its inception in 1970, USMES has been funded by the National Science Foundation to develop and carry out field trials of interdisciplinary units centered on long-range investigations of real and practical problems (or "challenges") taken from the local school/community environment. School planners can use these units to design a flexible curriculum for grades one through eight in which real problem solving plays an important role.

Development and field trials were carried out by teachers and students in the classroom with the assistance of university specialists at workshops and at occasional other meetings. The work was coordinated by a staff at the Education Development Center in Newton, Massachusetts. In addition, the staff at EDC coordinated implementation programs involving schools, districts, and colleges that are carrying out local USMES implementation programs for teachers and schools in their area.

Trial editions of the following units are currently available:

Advertising
Bicycle Transportation
Classroom Design
Classroom Management
Consumer Research
Describing People
Designing for Human Proportions
#Design Lab Design
#Eating in School
Getting There
Growing Plants
Manufacturing
Mass Communications
Nature Trails
Orientation
Pedestrian Crossings
Play Area Design and Use
Protecting Property
#School Rules
School Supplies
School Zoo
Soft Drink Design
Traffic Flow
#Using Free Time
Ways to Learn/Teach
Weather Predictions

*See *Goals for the Correlation of Elementary Science and Mathematics*, Houghton Mifflin Co., Boston, 1969.

#Available fall 1976.

USMES Resources

In responding to a long-range challenge, the students and teachers often have need of a wide range of resources. In fact, all of the people and materials in the school and community are important resources for USMES activities. USMES provides resources in addition to these. One resource for students is the Design Lab or its classroom equivalent: using the tools and supplies available, children can follow through on their ideas by constructing measuring tools, testing apparatus, models, etc. Another resource for students is the *"How To" Cards*. Each set of cards gives information about a specific problem; the students use a set only when they want help on that particular problem.

Several types of resources are available for teachers: the *USMES Guide*, a *Teacher Resource Book* for each challenge, *Background Papers*, a *Design Lab Manual*, and a *Curriculum Correlation Guide*. A complete set of all these written materials comprise what is called the USMES library. This library, which should be available in each school using USMES units, contains the following:

1. *The USMES Guide*

   The USMES Guide is a compilation of materials that may be used for long-range planning of a curriculum that incorporates the USMES program. In addition to basic information about the project, the challenges, and related materials, it contains charts assessing the strengths of the various challenges in terms of their possible subject area content.

2. *Teacher Resource Books* (one for each challenge)

   Each book contains a description of the USMES approach to real problem-solving activities, general information about the particular unit, edited logs of class activities, other written materials relevant to the unit, and charts that indicate the basic skills, processes, and areas of study that may be learned and utilized as students become engaged in certain possible activities.

3. *Design Lab Manual*

   This contains sections on the style of Design Lab activities, safety considerations, and an inventory

of tools and supplies. Because many "hands-on" activities may take place in the classroom, the Design Lab Manual should be made available to each USMES teacher.

4. *"How To" Cards*

   These short sets of cards provide information to students about specific problems that may arise during USMES units. Particular computation, graphing, and construction problems are discussed. A complete list of the "How To" Cards can be found in the USMES Guide.

5. *Background Papers*

   These papers are written to provide information for the teachers on technical problems that might arise as students carry on various investigations. A complete list of the Background Papers can be found in the USMES Guide.

6. *Curriculum Correlation Guide*

   This volume is intended to coordinate other curriculum materials with the Teacher Resource Books and to provide the teacher with the means to integrate USMES easily into other school activities and lessons.

The preceding materials are described in brief in the USMES brochure, which can be used by teachers and administrators to disseminate information about the program to the local community. A variety of other dissemination and implementation materials are also available for individuals and groups involved in local implementation programs. They include *Preparing People for USMES: An Implementation Resource Book*, the USMES slide/tape show, the Design Lab slide/tape show, the Design Lab brochure, the USMES newsletter, videotapes of classroom activities, a general report on evaluation results, a map showing the locations of schools conducting local implementation of USMES, a list of experienced USMES teachers and university consultants, and newspaper and magazine articles.

Acknowledgments

Besides the contributors listed at the beginning of the book, we are deeply indebted to the many elementary school

children whose investigations of the challenge form the basis for this book. Without their efforts this book would not have been possible. Many thanks to the Planning Committee for their years of service and advice. Many thanks also to other members of the USMES staff for their suggestions and advice and for their help in staffing and organizing the development workshops. Special thanks also go to Christopher Hale for his efforts as Project Manager during the development of this book.

* * *

Because Tri-Wall was the only readily available brand of three-layered cardboard at the time the project began, USMES has used it at workshops and in schools; consequently, references to Tri-Wall can be found throughout the Teacher Resource Books. The addresses of companies that supply three-layered cardboard can be found in the Design Lab Manual.

Introduction

Using the Teacher Resource Book

When teachers try a new curriculum for the first time, they need to understand the philosophy behind the curriculum. The USMES approach to student-initiated investigations of real problems is outlined in section A of this Teacher Resource Book.

Section B starts with a brief overview of possible student activities arising from the challenge; comments on prerequisite skills are included. Following that is a discussion of the classroom strategy for USMES real problem-solving activities, including introduction of the challenge, student activity, resources, and Design Lab use. Subsequent pages include a description of the use of the unit in primary grades, a flow chart and a composite log that indicate the range of possible student work, and a list of questions that the teacher may find useful for focusing the students' activities on the challenge.

Because students initiate all the activities in response to the challenge and because the work of one class may differ from that undertaken by other classes, teachers familiar with USMES need to read only sections A and B before introducing the challenge to students.

Section C of this book is the documentation section. These edited teachers' logs show the variety of ways in which students in different classes have worked at finding a solution to the challenge.

Section D contains a list of the titles of relevant sets of "How To" Cards and brief descriptions of the Background Papers pertaining to the unit. Also included in section D is a glossary of the terms used in the Teacher Resource Book and an annotated bibliography.

Section E contains charts that indicate the comparative strengths of the unit in terms of real problem solving, mathematics, science, social science, and language arts. It also contains a list of explicit examples of real problem solving and other subject area skills, processes, and areas of study learned and utilized in the unit. These charts and lists are based on documentation of activities that have taken place in USMES classes. Knowing ahead of time which basic skills and processes are likely to be utilized, teachers can postpone teaching that part of their regular program until later in the year. At that time students can study them in the usual way if they have not already learned them as part of their USMES activities.

A. Real Problem Solving and USMES

*If life were of such a constant nature that there were only a few chores to do and they were done over and over in exactly the same way, the case for knowing how to solve problems would not be so compelling. All one would have to do would be to learn how to do the few jobs at the outset. From then on he could rely on memory and habit. Fortunately--or unfortunately depending upon one's point of view--life is not simple and unchanging. Rather it is changing so rapidly that about all we can predict is that things will be different in the future. In such a world the ability to adjust and to solve one's problems is of paramount importance.**

Real Problem Solving

USMES is based on the beliefs that real problem solving is an important skill to be learned and that many math, science, social science, and language arts skills may be learned more quickly and easily within the context of student investigations of real problems. Real problem solving, as exemplified by USMES, implies a style of education which involves students in investigating and solving real problems. It provides the bridge between the abstractions of the school curriculum and the world of the student. Each USMES unit presents a problem in the form of a challenge that is interesting to children because it is both real and practical. The problem is real in several respects: (1) the problem applies to some aspect of student life in the school or community, (2) a solution is needed and not presently known, at least for the particular case in question, (3) the students must consider the entire situation with all the accompanying variables and complexities, and (4) the problem is such that the work done by the students can lead to some improvement in the situation. This expectation of useful accomplishment provides the motivation for children to carry out the comprehensive investigations needed to find some solution to the challenge.

The level at which the children approach the problems, the investigations that they carry out, and the solutions

*Kenneth B. Henderson and Robert E. Pingry, "Problem-Solving in Mathematics," in *The Learning of Mathematics: Its Theory and Practice*, Twenty-first Yearbook of the National Council of Teachers of Mathematics (Washington, D.C.: The Council, 1953), p. 233.

that they devise may vary according to the age and ability of the children. However, real problem solving involves them, at some level, in all aspects of the problem-solving process: definition of the problem; determination of the important factors in the problem; observation; measurement; collection of data; analysis of the data using graphs, charts, statistics, or whatever means the students can find; discussion; formulation and trial of suggested solutions; clarification of values; decision making; and communications of findings to others. In addition, students become more inquisitive, more cooperative in working with others, more critical in their thinking, more self-reliant, and more interested in helping to improve social conditions.

The USMES Approach

To learn the process of real problem solving, the students must encounter, formulate, and find some solution to complete and realistic problems. The students themselves, not the teacher, must analyze the problem, choose the variables that should be investigated, search out the facts, and judge the correctness of their hypotheses and conclusions. In real problem-solving activities, the teacher acts as a coordinator and collaborator, not an authoritative answer-giver.

The problem is first reworded by students in specific terms that apply to their school or community, and the various aspects of the problem are discussed by the class. The students then suggest approaches to the problem and set priorities for the investigations they plan to carry out. A typical USMES class consists of several groups working on different aspects of the problem. As the groups report periodically to the class on their progress, new directions are identified and new task forces are formed as needed. Thus, work on an USMES challenge provides students with a "discovery-learning" or "action-oriented" experience.

Real problem solving does not rely solely on the discovery-learning concept. In the real world people have access to certain facts and techniques when they recognize the need for them. The same should be true in the classroom. When the students find that certain facts and skills are necessary for continuing their investigation, they learn willingly and quickly in a more directed way to acquire these facts and skills. Consequently, the students should have available different resources that they may use as they recognize the need for them, but they should still be left with a wide scope to explore their own ideas and methods.

Certain information on specific skills is provided by the sets of USMES "How To" Cards. The students are referred only to the set for which they have clearly identified a need and only when they are unable to proceed on their own. Each "How To" Cards title clearly indicates the skill involved--"How to Use a Stopwatch," "How to Make a Bar Graph Picture of Your Data," etc. (A complete list of the "How To" Cards can be found in Chapter IX of the USMES Guide.)

Another resource provided by USMES is the Design Lab or its classroom equivalent. The Design Lab provides a central location for tools and materials where devices may be constructed and tested without appreciably disrupting other classroom activities. Ideally, it is a separate room with space for all necessary supplies and equipment and work space for the children. However, it may be as small as a corner of the classroom and may contain only a few tools and supplies. Since the benefits of real problem solving can be obtained by the students only if they have a means to follow up their ideas, the availability of a Design Lab can be a very important asset.

Optimally, the operation of the school's Design Lab should be such as to make it available to the students whenever they need it. It should be as free as possible from set scheduling or programming. The students use the Design Lab to try out their own ideas and/or to design, construct, test, and improve many devices initiated by their responses to the USMES challenges. While this optimum operation of the Design Lab may not always be possible due to various limitations, "hands-on" activities may take place in the classroom even though a Design Lab may not be available. (A detailed discussion of the Design Lab can be found in Chapter VI of the USMES Guide, while a complete list of "How To" Cards covering such Design Lab skills as sawing, gluing, nailing, soldering, is contained in Chapter IX.)

Work on all USMES challenges is not only sufficiently complex to require the collaboration of the whole class but also diverse enough to enable each student to contribute according to his/her interest and ability. However, it should be noted that if fewer than ten to twelve students from the class are carrying out the investigation of a unit challenge, the extent of their discovery and learning can be expected to be less than if more members of the class are involved. While it is possible for a class to work on two related units at the same time, in many classes the students progress better with just one.

The amount of time spent each week working on an USMES challenge is crucial to a successful resolution of the

problem. Each challenge is designed so that the various investigations will take from thirty to forty-five hours, depending on the age of the children, before some solution to the problem is found and some action is taken on the results of the investigations. Unless sessions are held at least two or three times a week, it is difficult for the children to maintain their interest and momentum and to become involved intensively with the challenge. The length of each session depends upon the age level of the children and the nature of the challenge. For example, children in the primary grades may proceed better by working on the challenge more frequently for shorter periods of time, perhaps fifteen to twenty minutes, while older children may proceed better by working less frequently for much longer periods of time.

Student interest and the overall accomplishments of the class in finding and implementing solutions to the challenge indicate when the class's general participation in unit activities should end. (Premature discontinuance of work on a specific challenge is often due more to waning interest on the part of the teacher than to that of the students.) However, some students may continue work on a voluntary basis on one problem, while the others begin to identify possible approaches to another USMES challenge.

Importance of the Challenge

Although individual (or group) discovery and student initiation of investigations is the process in USMES units, this does not imply the constant encouragement of random activity. Random activity has an important place in children's learning, and opportunities for it should be made available at various times. During USMES activities, however, it is believed that children learn to solve real problems only when their efforts are focused on finding some solution to the real and practical problem presented in the USMES challenge. It has been found that students are motivated to overcome many difficulties and frustrations in their efforts to achieve the goal of effecting some change or at least of providing some useful information to others. Because the children's commitment to finding a solution to the challenge is one of the keys to successful USMES work, it is extremely important that the challenge be introduced so that it is accepted by the class as an important problem to which they are willing to devote a considerable amount of time.

The challenge not only motivates the children by stating the problem but also provides them with a criterion for judging their results. This criterion--if it works, it's right (or if it helps us find an answer to our problem, it's

Role of the Teacher

a good thing to do)--gives the children's ideas and results a meaning within the context of their goal. Many teachers have found this concept to be a valuable strategy that not only allows the teacher to respond positively to all of the children's ideas but also helps the children themselves to judge the value of their efforts.

With all of the above in mind, it can be said that the teacher's responsibility in the USMES strategy for open classroom activities is as follows:

1. Introduce the challenge in a meaningful way that not only allows the children to relate it to their particular situation but also opens up various avenues of approach.

2. Act as a coordinator and collaborator. Assist, not direct, individuals or groups of students as they investigate different aspects of the problem.

3. Hold USMES sessions at least two or three times a week so that the children have a chance to become involved in the challenge and carry out comprehensive investigations.

4. Provide the tools and supplies necessary for initial hands-on work in the classroom or make arrangements for the children to work in the Design Lab.

5. Be patient in letting the children make their own mistakes and find their own way. Offer assistance or point out sources of help for specific information (such as the "How To" Cards) only when the children become frustrated in their approach to the problem. Conduct skill sessions as necessary.

6. Provide frequent opportunities for group reports and student exchanges of ideas in class discussions. In most cases, students will, by their own critical examination of the procedures they have used, improve or set new directions in their investigations.

7. If necessary, ask appropriate questions to stimulate the students' thinking so that they will make more extensive and comprehensive investigations or analyses of their data.

8. Make sure that a sufficient number of students (usually ten to twelve) are working on the challenge so that activities do not become fragmented or stall.

Student success in USMES unit activities is indicated by the progress they make in finding some solution to the challenge, not by following a particular line of investigation nor by obtaining specified results. The teacher's role in the USMES strategy is to provide a classroom atmosphere in which all students can, in their own way, search out some solution to the challenge.

USMES in the Total School Program

Today many leading educators feel that real problem solving (under different names) is an important skill to be learned. In this mode of learning particular emphasis is placed on developing skills to deal with real problems rather than the skills needed to obtain "correct" answers to contrived problems. Because of this and because of the interdisciplinary nature of both the problems and the resultant investigations, USMES is ideal for use as an important part of the elementary school program. Much of the time normally spent in the class on the traditional approaches to math, science, social science, and language arts skills can be safely assigned to USMES activities. In fact, as much as one-fourth to one-third of the total school program might be allotted to work on USMES challenges. Teachers who have worked with USMES for several years have each succeeding year successfully assigned to USMES activities the learning of a greater number of traditional skills. In addition, reports have indicated that students retain for a long time the skills and concepts learned and practiced during USMES activities. Therefore, the time normally spent in reinforcing required skills can be greatly reduced if these skills are learned and practiced in the context of real problem solving.

Because real problem-solving activities cannot possibly cover all the skills and concepts in the major subject areas, other curricula as well as other learning modes (such as "lecture method," "individual study topics," or programmed instruction) need to be used in conjunction with USMES in an optimal education program. However, the other

instruction will be enhanced by the skills, motivation, and understanding provided by real problem solving, and, in some cases, work on an USMES challenge provides the context within which the skills and concepts of the major subject areas find application.

In order for real problem solving taught by USMES to have an optimal value in the school program, class time should be apportioned with reason and forethought, and the sequence of challenges investigated by students during their years in elementary school should involve them in a variety of skills and processes. Because all activities are initiated by students in response to the challenge, it is impossible to state unequivocally which activities will take place. However, it is possible to use the documentation of activities that have taken place in USMES trial classes to schedule instruction on the specific skills and processes required by the school system. Teachers can postpone the traditional way of teaching the skills that might come up in work on an USMES challenge until later in the year. At that time students can learn the required skills in the usual way if they have not already learned them during their USMES activities.

These basic skills, processes, and areas of study are listed in charts and lists contained in each Teacher Resource Book. A teacher can use these charts to decide on an overall allocation of class time between USMES and traditional learning in the major subject disciplines. Examples of individual skills and processes are also given so that the teacher can see beforehand which skills a student may encounter during the course of his investigations. These charts and lists may be found in section E.

Ways In Which USMES Differs From Other Curricula

As the foregoing indicates, USMES differs significantly from other curricula. Real problem solving develops the problem-solving ability of students and does it in a way (learning-by-doing) that leads to a full understanding of the process. Because of the following differences, some teacher preparation is necessary. Some teachers may have been introduced by other projects to several of the following new developments in education, but few teachers have integrated all of them into the new style of teaching and learning that real problem solving involves.

1. <u>New Area of Learning</u>--Real problem solving is a new area of learning, not just a new approach or a new content within an already-defined subject area. Although many subject-matter curricula

include something called problem solving, much of this problem solving involves contrived problems or fragments of a whole situation and does not require the cognitive skills needed for the investigation of real and practical problems. Learning the cognitive strategy required for real problem solving is different from other kinds of learning.

3. Interdisciplinary Education--Real problem solving integrates the disciplines in a natural way; there is no need to impose a multi-disciplinary structure. Solving real and practical problems requires the application of skills, concepts, and processes from many disciplines. The number and range of disciplines are unrestricted and the importance of each is demonstrated in working toward the solution of practical problems.

3. Student Planning--To learn the process of problem solving, the students themselves, not the teacher, must analyze the problem, choose the variables that should be investigated, search out the facts, and judge the correctness of the hypotheses and conclusions. In real problem-solving activities the teacher acts as a coordinator and collaborator, not as an authoritative source of answers.

4. Learning-by-Doing--Learning-by-doing, or discovery learning as it is sometimes called, comes about naturally in real problem solving since the problems tackled by each class have unique aspects; for example, different lunchrooms or pedestrian crossings have different problems associated with them and, consequently, unique solutions. The challenge, as defined in each situation, provides the focus for the children's hands-on learning experiences, such as collecting real data; constructing measuring instruments, scale models, test equipment, etc.; trying their suggested improvements; and (in some units) preparing reports and presentations of their findings for the proper authorities.

5. Learning Skills and Concepts as Needed--Skills and concepts are learned in real problem solving

as the need for them arises in the context of the work being done, rather than having a situation imposed by the teacher or the textbook being used. Teachers may direct this learning when the need for it arises, or students may search out information themselves from resources provided.

6. Group Work--Progress toward a solution to a real problem usually requires the efforts of groups of students, not just individual students working alone. Although some work may be done individually, the total group effort provides good opportunities for division of labor and exchange of ideas among the groups and individuals. The grouping is flexible and changes in order to meet the needs of the different stages of investigation.

7. Student Choice--Real problem solving offers classes the opportunity to work on problems that are real to them, not just to the adults who prepare the curriculum. In addition, students may choose to investigate particular aspects of the problem according to their interest. The variety of activities ensuing from the challenge allows each student to make some contribution towards the solution of the problem according to his or her ability and to learn specific skills at a time when he or she is ready for that particular intellectual structure.

B. General Papers on Consumer Research

1. OVERVIEW OF ACTIVITIES

Challenge:

Determine which brand of a product is the best buy for a specific use.

Possible Class Challenges:

Determine which brand of paper towels is the most absorbent.

Determine which brand of pencil is best for us to use for math problems.

Determine which brand of cereal should be served at our school breakfasts.

Weighing potato chips.

Most children realize that not all consumer products live up to their claims. They have learned from their own experiences or from those of their parents that some purchases, initially thought to be good ones, later proved disappointing. Selecting a well-made product at a reasonable price can be as real a problem for students as for adults. Classes at all grade levels have responded enthusiastically to the idea of actual product testing.

The Consumer Research challenge may arise from a class debate over the quality of some product purchased by the children, their parents, or the school. Sometimes work on another challenge may lead to a consumer problem. For example, students may decide to test different brands of a product they plan to sell in their school store.

Once a need for testing a particular product has been identified, the class works together or in small groups to formulate test objectives and procedures. Some students may decide to conduct a preference survey to determine the most popular brands of the product. Survey data is displayed on bar graphs or histograms.

After comparison shopping at different stores, children can construct slope diagrams for easy comparison of data on prices and quantities. They may then purchase the brands themselves from the store(s) offering the best buys. Brands are ranked from least expensive to most expensive by constructing more slope diagrams or by computing the actual cost per unit.

After identifying the important properties of the product, such as the lifetime of pens or the strength and absorbing quality of paper towels, the class obtains quantitative data by designing and carrying out tests on these properties. To insure uniform, objective measures, children often design and construct testing apparatus. The same tests may be repeated several times and the median values used in brand comparisons. Using the data acquired from their tests, the students may also calculate areas or volumes. Test results are depicted on bar graphs, line graphs, or histograms.

Test procedures and results are periodically reviewed by the class to appraise the apparatus constructed, as well as the suitability and validity of the tests. When the tests have been completed, the students look at their graphs to

Displaying results of popcorn tests.

compare sets of data. Test data may be analyzed further by using means, medians, and ranges and sometimes by constructing q-q plots. Children then usually rank the brand performance on each test from best to worst.

In determining which brand is the best buy, the class considers certain trade-offs in terms of one property versus another and of price versus quality. For example, a brand of paper towels that has greater scrubbing strength but less absorbency may be chosen over another brand with test results in the reverse order. Also, a lower quality brand that is less expensive may adequately serve the purpose of the students and thus be selected as the "best buy."

After evaluating several brands of a product, the students may decide to inform other people about their test procedures and findings. They may prepare a newsletter report for their schoolmates, and they may write letters to their parents and perhaps to the distributors or manufacturers of products that have not lived up to their claims.

When the testing of one product has been completed, students may decide to continue their research by testing other products. A permanent consumer information/product testing group might be formed. As a follow-up activity, the children may decide to manufacture a new consumer product. They might consequently explore production and marketing techniques, which could lead to both Manufacturing and Advertising challenges.

Although many of these research activities may require skills and concepts new to the children, there is no need for preliminary work on these skills and concepts because the children learn more quickly and easily when they see a need to learn. Consider counting: whereas children usually learn to count by rote, they can, through USMES, gain a better understanding of counting by learning or practicing it within real contexts. In working on a Consumer Research challenge, children usually learn and practice graphing, measuring, working with decimals, and dividing. Although dividing seems necessary to compare fractions or ratios, primary children can make comparisons graphically; sets of data can also be compared graphically or by subtracting medians (half-way values). Furthermore, instead of using division to make scale drawings, younger children can convert their measurements to spaces on graph paper. Division may be introduced at the proper grade level during calculation of percentages, averages, or unit costs.

2. CLASSROOM STRATEGY FOR CONSUMER RESEARCH

The Consumer Research unit revolves around a challenge--a statement that says, "Solve this problem." Its success or failure depends largely on (1) the relevance of the problem for the students and (2) the process by which they define and accept the challenge. If the children see the problem as a real one, they will be committed to finding a solution; they will have a focus and purpose for their activities. If the students do not think the problem affects them, their attempts at finding solutions will likely be disjointed and cursory.

The Consumer Research challenge--"Determine which brand of a product is the best buy for a specific use"--is general enough to apply to many situations. Students in different classes define and reword the challenge to fit the particular product(s) they are investigating and thus arrive at a specific class challenge. For example, some classes have restated the challenge in terms of finding which brand of glue is the most adhesive or which brand of cereal is the least soggy.

The Process of Introducing the Challenge

Given that a problem exists, how can a teacher, without being directive, help the students identify the challenge that they will work on as a group? There is no set method because of variations among teachers, classes, and schools and among the USMES units themselves. However, USMES teachers have found that certain general techniques in introducing the challenge are helpful.

One such technique is to turn a spontaneous discussion of some recent event toward a related Consumer Research challenge. For example, a class debate about the quality of some product purchased by the children, their parents, or the school may lead to a Consumer Research challenge.

A sixth grader in one class complained about a product he had purchased that later proved to be defective. His teacher asked him and his classmates to relate their recent purchasing experiences. What had they bought? Why had they selected a particular product or brand? The students noted differences among purchases and identified distinctions among consumer groups. They discussed and compared important product characteristics and other factors that motivated their purchases. The teacher asked several questions about the quality of their purchases: Did they make the best purchase? How could they prove that they got the

best buy for their money? By focusing on these questions, the children became involved in the key questions posed by the Consumer Research challenge.

While a third-grade class was discussing the Halloween treats they had received the previous night, the teacher took advantage of the opportunity to ask the students about their favorite kinds of candy. When M & M's were mentioned, everyone knew that they weren't supposed to "melt in your hand"; however, most of the students seemed to feel that this claim was untrue. When they related experiences they had had with melting M & M's, the teacher suggested that if they were interested, they could find out for themselves if the advertisement for M & M's was true. The students conducted tests on M & M's and two other similar brands of candy for meltability, cost, and flavor.

Sometimes work on another challenge, for example, Advertising, Manufacturing, Soft Drink Design, or School Supplies, may lead to a Consumer Research challenge.

Two fifth-grade classes became involved in testing products as a result of their joint efforts in operating a school store. The students were induced to make price/quality comparisons between brands of pencils when the student clientele complained about the high price of pencils they sold. They also decided to compare brands of pens and brands of other items they sold in order to "insure" the quality of their products and the continued patronage of the school population.

When children working on one challenge encounter a problem that leads to a related Consumer Research challenge, one group of children may begin work on this second challenge while the rest of the class continues with the first challenge. However, there should be at least ten to twelve students working on any one challenge; otherwise, the children's work may be fragmented or superficial or may break down completely.

A Consumer Research challenge may also evolve from a discussion of a specific topic being studied by the class.

One class of fourth graders initially studied advertisements that were televised or published. They carefully noted the contents and the amounts of time or space allocated, and they debated the intents of the advertisements. The children also discussed the effects of ads and commercials on consumer purchases. Their teacher asked whether they thought that commercials achieved their purpose: Were they believable? Did they prove that their product was best? To evaluate the truthfulness of advertisements, the class decided to test several product brands and compare the test results with the claims of the commercials.

Sometimes the discussion of a broad problem may encompass the challenges of several related units. For example, a discussion of a current social issue, such as consumer protection, may lead to Consumer Research, Advertising, or Manufacturing challenges as specific problems are identified.

An experienced USMES teacher is usually willing to have the children work on any one of the several challenges that may arise during the discussion of a broad problem. While this approach gives the children the opportunity to select the challenge they are most interested in investigating, it does place on the teacher the additional responsibility of being prepared to act as a resource person for whichever challenge is chosen.

Classroom experience has shown that children's progress on a Consumer Research challenge may be poor if the teacher and students do not reach a common understanding of what the challenge is before beginning work on it. When a very general challenge is issued to "test products," the activities are often viewed by the children as purposeless. Having no need to compare product brands, the children will lack the motivation inherent in working together to solve a real problem. As a result, their decisions regarding the selection and testing of products tend to be arbitrary, and they may quickly lose interest.

In one class the teacher introduced the general Consumer Research challenge and then allowed the

students to select products randomly for testing. One group began "testing" the prices of houses, but their entire work consisted of copying "For Sale" advertisements from newspapers and trying unsuccessfully to conduct telephone interviews with people who advertised houses for sale. The students soon became discouraged because they actually had little understanding about housing costs versus location, size, and other factors, and they couldn't think of any other investigations to perform. Consequently, they stopped working on the challenge altogether.

The best way to avoid these problems is to discuss what products are purchased frequently by the students, their parents, or the school, or to wait until the children have exhibited a need for testing a particular product before introducing the challenge. The more relevant the problem is to their immediate activities, the more motivated the children will be to solve it.

When a very general challenge is given, the children may select products that they are incapable of actually testing (e.g., sewing machines, motorcycles, automobile tires) because of size or expense. The teacher can often help the children foresee potential difficulties by asking how they plan to test the products. The students themselves may then realize the problems involved in testing the products in the classroom or Design Lab and decide to investigate more testable items.

Initial Work on the Challenge

Once a class has decided to work on a Consumer Research challenge, USMES sessions should be held several times a week, but they need not be rigidly scheduled. When sessions are held after long intervals, students often have difficulty remembering exactly where they were in their investigations and their momentum diminishes.

When students begin work on their particular challenge, they list the most common uses and the important properties of the product. Next, they categorize their ideas, grouping similar ones together, and they decide on test objectives. The children then set priorities for the tasks they consider necessary to test the product.

Often a class divides into groups to carry out their product testing. However, if too many groups are formed, work on the challenge can become fragmented. The teacher

Checking data.

Refocusing on the Challenge

finds it impossible to be aware of the progress and problems of each group; in addition, the small number of students in each group lessens the chance for varied input and interaction.

> *In one intermediate class the teacher allowed the children to select products arbitrarily and did not provide the opportunity for groups to report to the class. The students formed ten groups, each testing a different product. Because the teacher's attention was divided among so many groups, it became increasingly difficult to keep track of the numerous activities taking place. Consequently, membership in different groups often varied, with students changing from one group to another. Some groups became easily discouraged when they were faced with problems and, instead of trying to resolve them, they merely switched to testing another product. As a result, none of the groups conducted comprehensive investigations, and even after some had collected data, they were at a loss as to what to do with it.*

Since most children have not had actual experience using a scientific approach to test products, many teachers find that the most effective work is accomplished when the entire class first works together to test only one product. Various groups can perform the same or different tests and then discuss the steps they followed and the results they obtained. By focusing their attention on one product, the students are able to go through the various steps leading to valid tests. Later the class can form several groups, each testing a different product in which the children are interested. Again, it is important that the number of groups not be too large.

As a class works on a Consumer Research challenge, the children's attention should, from time to time, be refocused on that challenge so that they do not lose sight of their overall goal. Refocusing is particularly important with younger children because they have a shorter attention span. Teachers find it helpful to hold periodic class discussions that include group reports. Such sessions help the students review what they have accomplished and what they still need to do in order to find some solution to the problem. These

discussions also provide an opportunity for students to participate both in evaluating their own work and in exchanging ideas with their classmates. (Another consequence of having too many groups is that not every group can be given enough time to report to the class, thereby increasing the possibility that the children's efforts will overlap unnecessarily.)

Resources for Work on the Challenge

When children try to decide on solutions before collecting and analyzing enough data or when they encounter difficulties during their investigations, an USMES teacher helps out. Instead of giving answers or suggesting specific procedures, the teacher asks open-ended questions that stimulate the students to think more comprehensively and creatively about their work. For example, instead of telling students involved in a Consumer Research investigation that their tests were invalid because they did not use consistent testing procedures for different brands, the teacher might ask, "How can you make sure that you test all your products fairly?" Examples of other nondirective, thought-provoking questions are listed in section B-6.

The teacher may also refer students to the "How To" Cards, which provide information about specific skills, such as using a stopwatch or drawing graphs. A list of those "How To" Cards pertinent to Consumer Research can be found in section D-1. If many students, or even the entire class, need help in particular areas, such as using fractions, the teacher should conduct skill sessions as these needs arise. (Background Papers provide teachers with additional information on specific problems associated with some challenges and on general topics applicable to most challenges.)

USMES teachers can also assist students by making it possible for them to carry out tasks involving hands-on activities. For example, if the children need to collect data outside their classroom--at local stores or in other classrooms--the teacher can help with scheduling and supervision. If the children's tasks require them to design and construct items, such as testing apparatus, the teacher should make sure that they have access to a Design Lab. Any collection of tools and materials kept in a central location (in part of the classroom, on a portable cart, or in a separate room) can be called the Design Lab.

Valuable as it is, a Design Lab is not necessary to begin work on a Consumer Research challenge. The Design Lab is used only when needed, and, depending on the investigations decided on by the children, the need may not arise at all. For example--

A sixth-grade class worked successfully on a Consumer Research challenge without the use of a Design Lab. One group of children in the class decided to compare three brands of bacon to find out which was the best in each of three categories--greasiness, shrinkage, and price. To conduct their tests, they purchased the bacon at a supermarket and brought all other supplies from home. These included a measuring cup, an electric fryer, a large frying pan, a hot plate, two large forks, paper towels, and napkins. Using these supplies, they then carried out their testing in the classroom.

Fifth graders at another school performed a variety of tests to determine the best of three brands of string for flying a kite. All of their testing was done without the use of a Design Lab. The tests they performed included strength (suspending weights from string and pulling objects like desks, chairs); breakability (rubbing against edge of desk, snapping a ruler across it); flying ability (suspending string across heater); weight; and a practical test (made kites and flew them).

To carry out construction activities in schools without Design Labs, students may scrounge or borrow tools and supplies from parents, local businesses, or other members of the community.

The extent to which any Design Lab is used for Consumer Research varies with different classes because the children themselves determine the direction of the investigations and because construction activities are more likely to be needed for testing some products than for others.

Culminating Activities

Student investigations on a Consumer Research challenge generally continue until the children feel that they have reached valid conclusions about the performances of product brands. Often they will decide that other people should be informed about the results of their product testing. Some classes have written letters to their parents describing their testing procedures and results. Others have written articles for the school bulletin or school newspaper. If the students find that a particular brand is defective in some way or doesn't live up to its advertising claims, they

may decide to write directly to the manufacturer or to the local stores selling that brand, detailing the activities that led to their conclusion.

A combination class of fifth and sixth graders compared the pencil brand they sold with another brand sold at a local store. After repeated testing, the children felt that they had accurate proof that their pencil brand was superior in quality. One group of students wrote a letter to the local store manager, including details about their testing procedures and results, and other students prepared a consumer report for the school.

While testing shampoos, one group of eighth-grade girls wrote to several manufacturers requesting information about their particular brands. One company responded with an information sheet that gave a brief history of shampoo, answers to some of the most frequently asked questions about shampoo, and performance characteristics a shampoo should have. The girls were elated to find that they had identified and tested several of these characteristics, such as amount of suds and irritation to skin. They later wrote to the manufacturer of one shampoo that, according to their tests, could dry the scalp and irritate the skin.

Whenever possible, students should be encouraged to participate in these types of activities. Teachers have found that when their classes communicate their test findings to others, the students are more precise in their data collection and analysis, and they often repeat tests several times to insure accuracy. Also, the students can better understand the importance of presenting their information in a clear and readable manner so that it can be easily understood by others.

3. USE OF CONSUMER RESEARCH IN THE PRIMARY GRADES

Young children are consumers, too, and they can be as concerned as older students about the quality of the products they use or purchase. Although they may lack advanced skills needed to carry out more refined investigations, primary children are able to devise and carry out tests, collect data, and make adequate brand comparisons.

Class debates about the quality of a product or the truthfulness of certain advertising claims can lead to a lively discussion as the children relate their own experiences with different products. The Consumer Research challenge may arise from such a discussion or from children's complaints about defective products. Since young children are naturally egocentric, it is essential for maintaining their interest and enthusiasm that the challenge focus on a product that they choose and frequently use. Most primary teachers have found that research activities are most successful when the entire class works together to test a few brands of only one product. As the children become more adept at their investigations, the teacher can then encourage group work on the same or different research activities.

Consumer Research provides many opportunities for children to learn and practice counting skills and especially to relate those skills to the real world. Tallying can be introduced as a shorter way to keep track of many numbers. Classes often compare brand quantities by counting the number of items per package. While testing paper towel brands, a group of third-grade boys counted the number of towels per roll to check the accuracy of the package claims. When the first brand became billowed and twisted as it was unrolled, the boys decided to fold the towels into groups of ten for easier counting.

Quantity comparisons may require the use of measuring tools. Simple approximations can be made using familiar objects, such as lengths of string. The children learn by experience that as long as the same unit of measure is used for different brands, the results can be meaningfully compared. When they see a need for standard units of measure, they can learn to use the more common measuring tools. Several classes have measured the duration of their tests by using stopwatches.

As they continue with their testing activities, young children become increasingly aware of the importance of valid results. They will sometimes insist that a test be repeated several times to check the accuracy of the results. Several second graders who were testing paper towels realized that they were not treating all brands equally; one child's

"yank" or "scrub," they pointed out, was not necessarily the same as that of another child.

To standardize their testing procedures, children sometimes construct simple testing apparatus. For example, one third-grade boy, concerned about using equal pressure when testing the lifetimes of felt-tip markers, created a testing device made from the chassis of a toy car, a rubber band, Tri-Wall, and glue. In other primary classes children have built apparatus to use in measuring the strength and durability of paper towels. One group of second graders worked very hard to design and construct an equal arm balance for weighing their product brands.

Graphing skills may be introduced to primary students as an easy way to see and compare data. "Stack 'em" graphs and pegboard graphs are especially useful in helping primary children visualize graphic constructions. One second-grade class made a bar graph tally to show the results of their preference survey on paper towels. As each tally mark was added, cheers erupted from the students who were eagerly rooting for their favorite brands to win the popularity "race." Later they constructed bar graphs to show results from their strength tests on four paper towel brands.

If a primary class wants to find an "average" test score for each brand, the children can use the median, which is easier to find and often more accurate than the average. They simply order the data from largest to smallest and then count to find the middle number.

Primary children cannot make complicated price per unit computations involving decimals or fractions; however, they can use several simple methods to determine an approximate cost. One second-grade class, for example, was unable to compute the exact cost of each lollipop in a bag of twenty-three lollipops selling for 39¢. Their teacher helped them solve the problem by using set theory (see log by Dorothy Galuzzo), and the children determined that the cost per lollipop was between one cent and two cents, or one cent plus a little more. Slope diagrams also provide a simple method for ordering brand prices from most expensive per item or per weight to least expensive.

During Consumer Research activities primary children have many opportunities to learn, practice, and develop language arts skills. Class and group discussions provide a time for learning good communication habits—attention, participation, and interaction. Children may also practice their writing skills in several ways. Recording data is a part of every product investigation. Second graders in one class designed

a "research paper," a data collection sheet for recording comparison shopping information on brand availability and cost at different stores. Simple surveys may be devised should the children decide to find out about other people's brand preferences.

Primary students also use communication skills, including writing letters and reports, to inform their parents and schoolmates about their research activities. One class was so excited about their test results that the children made up slogans for the best performing brands.

To successfully participate in, and benefit from, the Consumer Research unit, primary children need only to sustain continuing interest in fulfilling the challenge. The interdisciplinary approach needed for the investigations and the use of interpersonal skills help in the development of the "whole" child. Through their work on the challenge, children begin to develop problem-solving abilities that will enable them to become more discriminating consumers.

4. FLOW CHART

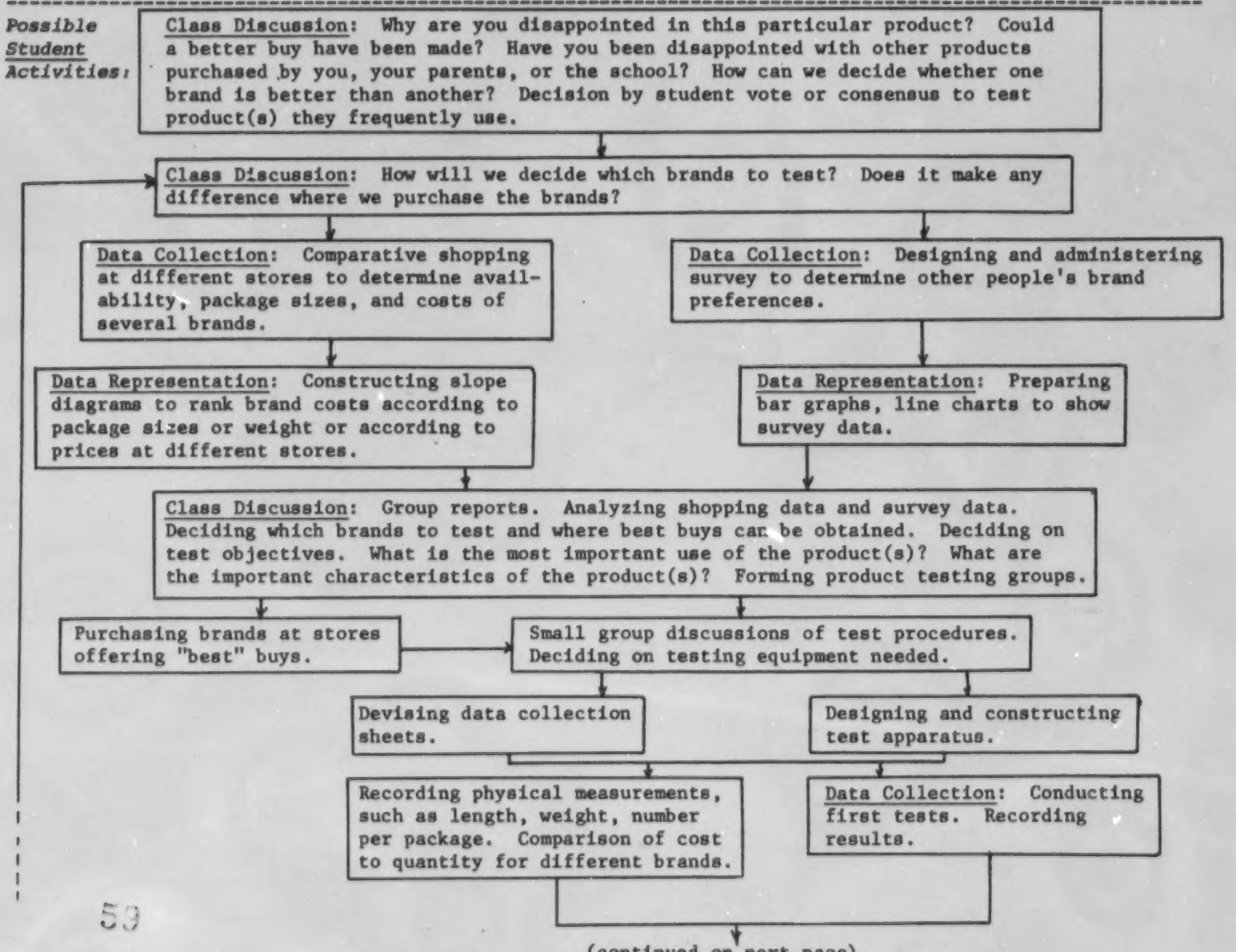
The following flow chart presents some of the student activities--discussions, observations, calculations, constructions--that may occur during work on a Consumer Research challenge. Because each class will choose its own approach to the challenge, the sequences of events given here represent only a few of the many possible variations. Furthermore, no one class is expected to undertake all the activities listed.

The flow chart is not a lesson plan and should not be used as one. Instead, it illustrates how comprehensive investigations evolve from the students' discussion of a Consumer Research problem.

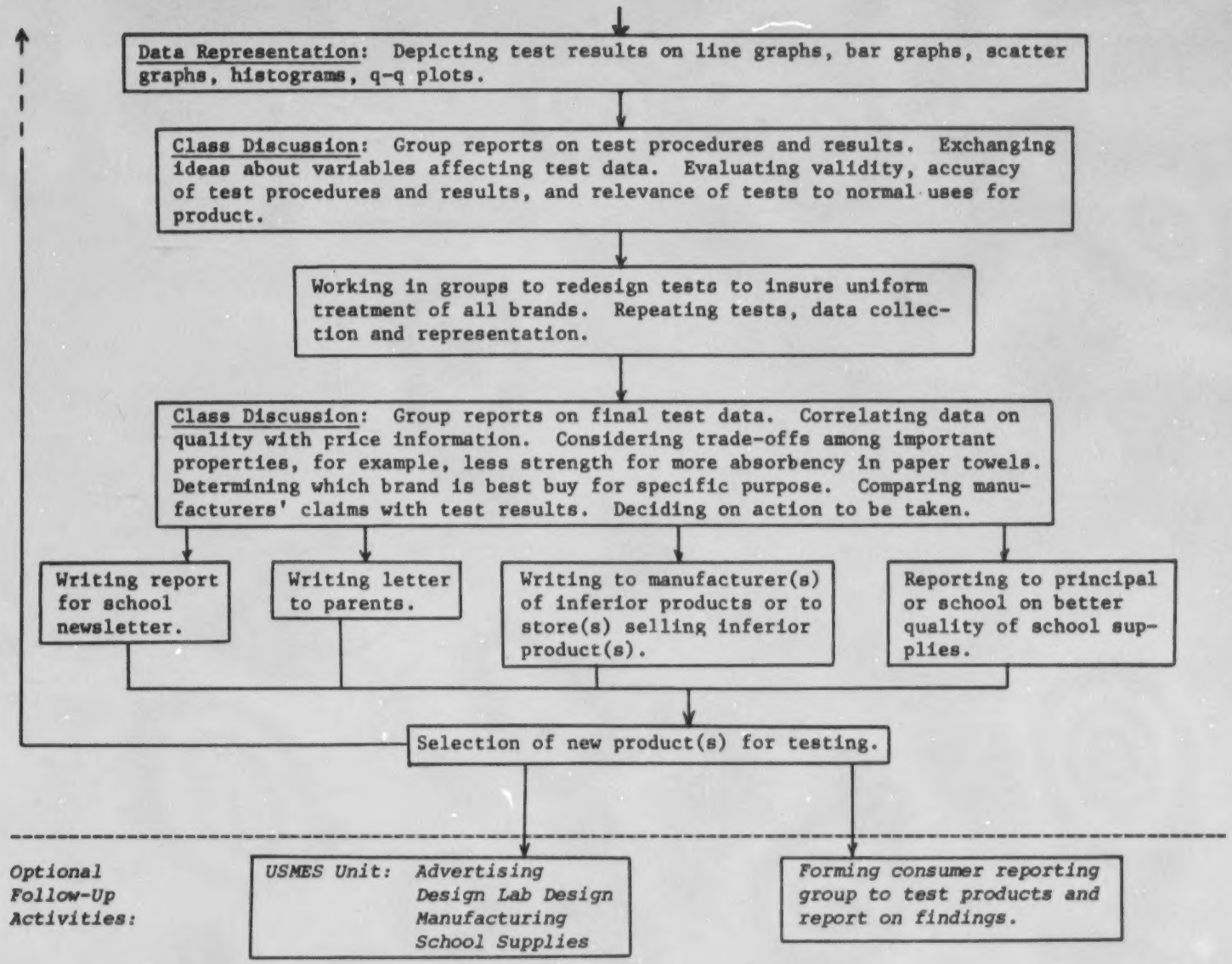
Challenge: Determine which brand of a product is the best buy for a specific use.

Work Leading to Challenge:	*Social Science Unit on Consumerism.*	*Analyze Advertisements, TV commercials.*	*USMES Unit:*	*Advertising Design Lab Design Protecting Property*	*Manufacturing School Supplies*

Possible Student Activities:


Class Discussion: Why are you disappointed in this particular product? Could a better buy have been made? Have you been disappointed with other products purchased by you, your parents, or the school? How can we decide whether one brand is better than another? Decision by student vote or consensus to test product(s) they frequently use.
Class Discussion: How will we decide which brands to test? Does it make any difference where we purchase the brands?
Data Collection: Comparative shopping at different stores to determine availability, package sizes, and costs of several brands.
Data Collection: Designing and administering survey to determine other people's brand preferences.
Data Representation: Constructing slope diagrams to rank brand costs according to package sizes or weight or according to prices at different stores.
Data Representation: Preparing bar graphs, line charts to show survey data.
Class Discussion: Group reports. Analyzing shopping data and survey data. Deciding which brands to test and where best buys can be obtained. Deciding on test objectives. What is the most important use of the product(s)? What are the important characteristics of the product(s)? Forming product testing groups.
Purchasing brands at stores offering "best" buys.
Small group discussions of test procedures. Deciding on testing equipment needed.
Devising data collection sheets.
Designing and constructing test apparatus.
Recording physical measurements, such as length, weight, number per package. Comparison of cost to quantity for different brands.
Data Collection: Conducting first tests. Recording results.

(continued on next page)


Data Representation: Depicting test results on line graphs, bar graphs, scatter graphs, histograms, q-q plots.
Class Discussion: Group reports on test procedures and results. Exchanging ideas about variables affecting test data. Evaluating validity, accuracy of test procedures and results, and relevance of tests to normal uses for product.
Working in groups to redesign tests to insure uniform treatment of all brands. Repeating tests, data collection and representation.
Class Discussion: Group reports on final test data. Correlating data on quality with price information. Considering trade-offs among important properties, for example, less strength for more absorbency in paper towels. Determining which brand is best buy for specific purpose. Comparing manufacturers' claims with test results. Deciding on action to be taken.
Writing report for school newsletter.
Writing letter to parents.
Writing to manufacturer(s) of inferior products or to store(s) selling inferior product(s).
Reporting to principal or school on better quality of school supplies.
Selection of new product(s) for testing.
Optional Follow-Up Activities:
USMES Unit: Advertising Design Lab Design Manufacturing School Supplies
Forming consumer reporting group to test products and report on findings.

5. A COMPOSITE LOG*

This hypothetical account of an intermediate-level class describes many of the activities and discussions mentioned in the flow chart. The composite log shows only one of the many progressions of events that might develop as a class investigates the Consumer Research challenge. Documented events from actual classes are italicized and set apart from the text.

One day during a discussion about coming events in the school and community, two students mention a kite flying contest that was announced that morning. In relating their experiences in flying kites several students say that they have had trouble with the string breaking and have lost kites as a result. Other students say that they thought the string they used was too heavy and the kites didn't fly well. The teacher asks them if they would like to spend some time in science class finding out what kite string is the best to use.

Although several in the class are interested, others aren't, and the teacher asks if there is another product they have trouble deciding what brand to buy. One student says that there are so many brands of potato chips in the store that she didn't know which to buy for a birthday party she'd had. Others say, "We don't like the potato chips we get at lunch at school; let's find out which brand is best and tell the lunch people about it."

A fifth-grade class in Marina, California, discussed what they bought with their own money and how they made choices between the item they bought and other items that were almost like it. Many students agreed that they could have made better choices because things fell apart or broke quickly. In listing the products to investigate the class mentioned kites, clothes, and paper, showing the most interest in kites. The students then talked about what they could find out about kites and finally decided to test kite strings first and kites later. (From log by William Kucher.)

The next day in science class the teacher writes two challenges on the board:

Find out what string is best for flying kites.
Find out what brand of potato chips is best for the school to serve at lunch.

The class then discusses important characteristics of each product. The following lists are put on the board:

*Written by USMES staff

Kite String	Potato Chips
doesn't cost too much	don't cost too much
doesn't break easily	taste good
isn't too heavy	aren't too salty
isn't too thick	don't get stale quickly
	aren't greasy
	don't break easily
	are crisp

The class spends most of the remainder of the period in two groups discussing how they can test for those characteristics. The string group reports that costs can be gotten from the different packages. They also say that they can hang books or something else on the different strings until they break. The number of books it takes to break a string will tell how strong it is. The string group also reports that they can weigh the strings and can look at the strings to compare thicknesses. Some students in the other group remark that a thick and light string flies better than a thin string that is the same weight. The string group replies that they will think about ways to check that.

The potato chip group reports that they will have to taste the potato chips to see which brand they like best. The rest of the class says that they want to taste the different brands since they have to eat them at lunch, too. At the end of the period both groups agree to bring in kite strings and potato chips to test the next day.

A kindergarten class in Iowa City, Iowa, started one day with a discussion about a good breakfast. In discussing good things to eat for breakfast the children mentioned different kinds of cereals. When asked how they could tell which cereal was best, they suggested finding out how much sugar is in it, how it tastes, what vitamins are in it, and whether it has extra things like marshmallows. (From log by Susan Marquis.)

The fifth-grade class investigating kite strings decided to test for strength, length, price, weight, handling, and durability. Later, after possible tests were identified, the class tested both dry and wet strings for strength (suspending weights and pulling objects), breakability (rubbing against object, hitting with an object), and flying (placing

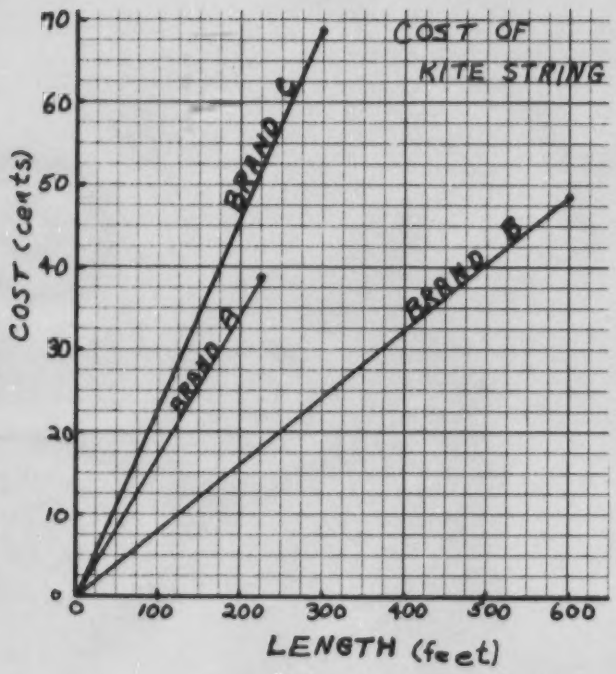


Figure B5-1

in front of a forced air heater). Each student kept a log describing the tests conducted and results obtained. (From log by William Kucher.)

The next day the teacher asks the students to look at the list of characteristics on the board and decide what they should do first in their investigations of kite strings and potato chips. Both groups agree that they have to figure costs before they lose the wrappings. The two groups then record on separate charts the information below.

Kite Strings

Brand	Cost	Length
A	39¢	225 ft.
B	49¢	600 ft.
C	69¢	300 ft.

Potato Chips

Brand	Cost	Weight
A	69¢	8 oz.
B	69¢	9 oz.
C	79¢	8 oz.
D	79¢	7½ oz.
E	57¢	4½ oz.
F	89¢	9.5 oz.

After looking closely at the data the string group tells the teacher that because the balls of string are all different lengths, they can't compare prices. The teacher then calls both groups together to show them an easy way to compare prices. She uses the data from the string group to make a slope diagram. (See Figure B5-1.) She explains that they can tell which string costs less per foot by comparing the steepness of the lines. Because cost is on the vertical axis, the line that has the smallest slope is the cheapest per foot. They agree that brand B costs the least per foot. However, one student breaks the string easily and says that it's cheap because it isn't very strong. The group then decides that they have to test strength first.

Students in one second-grade class in Arlington, Massachusetts, decided to investigate lollipops. They wanted to compare the prices of the different

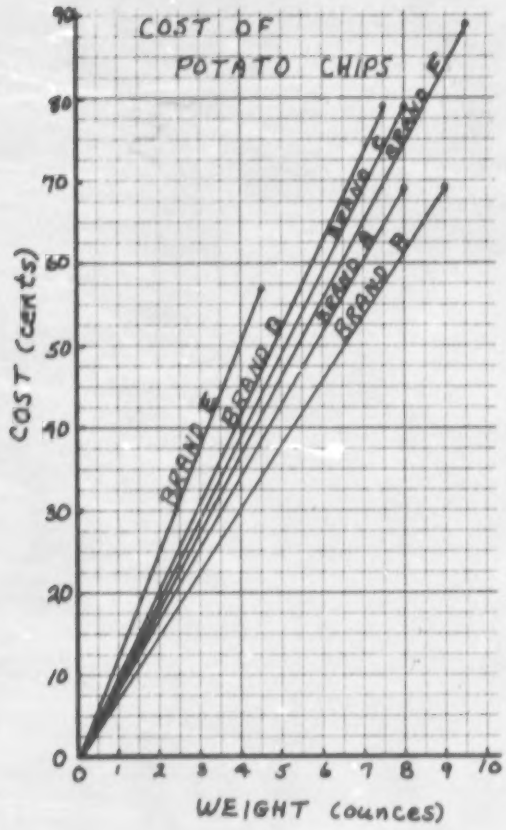


Figure B5-2

brands but did not have the division skills necessary to find the cost of one lollipop. However, they were able to determine approximate price by using set theory. They drew circles, each representing one lollipop in a package, and then placed dots in the circles, each dot representing one cent of the cost. Thus, they were able to determine that in a thirty-nine cent package containing twenty-three lollipops, some lollipops would cost one cent and some would cost two cents. Therefore, they decided that each lollipop would cost one cent plus. (See log by Dorothy Galuzzo.)

A group of fourth-grade students in Burnsville, Minnesota, investigated different characteristics of dry cereals. To compare the prices of the cereals bought in one store, they drew a slope diagram that showed the price per ounce of each cereal. They then checked the prices at two other stores and drew a slope diagram for each store that showed the price per ounce of the same cereals. By comparing the three slope diagrams they were able to determine which store had the best prices for those three cereals. (See mini-log by Sandra Stevens.)

The potato chip group makes a slope diagram from their data (see Figure B5-2) and sees that although the lines are close together, brand B costs less per ounce. The group then looks at the list of characteristics and decides that most of them are a matter of taste. Some people like salty potato chips; others don't. They agree that they will have to ask many students which brand they like best. However, they think that people might have favorite brands and pick those brands because they don't know how other brands taste. The group finally decides (1) that each person has to taste each brand before saying which he or she likes best, and (2) that the brands will not be identified for the taster.

Two students take the bag of potato chips to the other end of the room and put small quantities of each on paper towels labeled A, B, C, D, E, and F. The others then taste the chips one at a time and write down which they like best. Several complain that they can't make up their minds--several brands taste alike. Others say that the taste from one brand stays in their mouths and they can't do anything about it.

	Like a lot	Like a little	Don't like
Brand A	𝍸	𝍸 𝍸 ||||	𝍸 𝍸 |
Brand B	𝍸	𝍸 𝍸 |	𝍸 𝍸 ||||
Brand C	𝍸 𝍸 ||	𝍸 𝍸 𝍸	|||
Brand D	𝍸 𝍸 𝍸	𝍸 𝍸 |||	||
Brand E	𝍸 𝍸	𝍸 𝍸 𝍸	𝍸
Brand F	𝍸 𝍸 ||||	𝍸 𝍸 𝍸	|

Figure B5-3

	Like a lot 2 points	Like a little 1 point	Total
Brand A	5 x 2 = 10	14 x 1 = 14	24
Brand B	5 x 2 = 10	11 x 1 = 11	21
Brand C	12 x 2 = 24	15 x 1 = 15	39
Brand D	15 x 2 = 30	13 x 1 = 13	43
Brand E	10 x 2 = 20	15 x 1 = 15	35
Brand F	14 x 2 = 28	15 x 1 = 15	43

Figure B5-4

The next day the group discusses the taste test problem with the class. One student says that she had seen an ad where people take drinks of water between tastes of tea. Another student says that they should switch the order of the potato chips each time so that sometimes a brand would be tasted first and sometimes last. The potato chip group agrees that these are good ideas.

The teacher then asks the group to think about how they are going to record results of the test. The group decides to put tally marks on a paper marked with columns for "like a lot," "like a little," and "don't like."

The group tries out the ideas of switching the order of the brands and alternating tastes of potato chips with drinks of water. After each taste, a member of the group asks the person whether he or she liked the potato chip a lot, a little, or not at all.

The group finds that everything works out fine. However, they realize that they can't ask everyone in the school to take part in the test because it would take too much time and too many potato chips. They decide to pick five children from each grade and, after a long discussion, agree to ask every fifth person in the lunch line until they have the five for the test from that particular grade.

The tests are conducted after school the next week in their classroom and the group brings the results (see Figure B5-3) to class the next day. They report that they tested thirty students and then checked the chart to make sure that each brand had thirty tally marks. The teacher asks if they can think of a way to give each answer a number so that the results can be compared. One student suggests giving points; because "like a lot" is the top score, it should get two points. Others say, "Then 'like a little' can get one point, and 'don't like' doesn't get anything." The group figures out the number of total points for each brand and discovers that brands D and F are tied for first place with forty-three points each. After consulting with the teacher, the group makes a bar graph of their data in order to make it easier to explain to the class. (See Figures B5-4 and B5-5 for data and graph.)

A combination sixth/seventh-grade class in Chicago, Illinois, investigated different brands of popcorn. In the course of their investigations they conducted a survey to determine student preferences and also a taste test of the four most popular brands. The re-

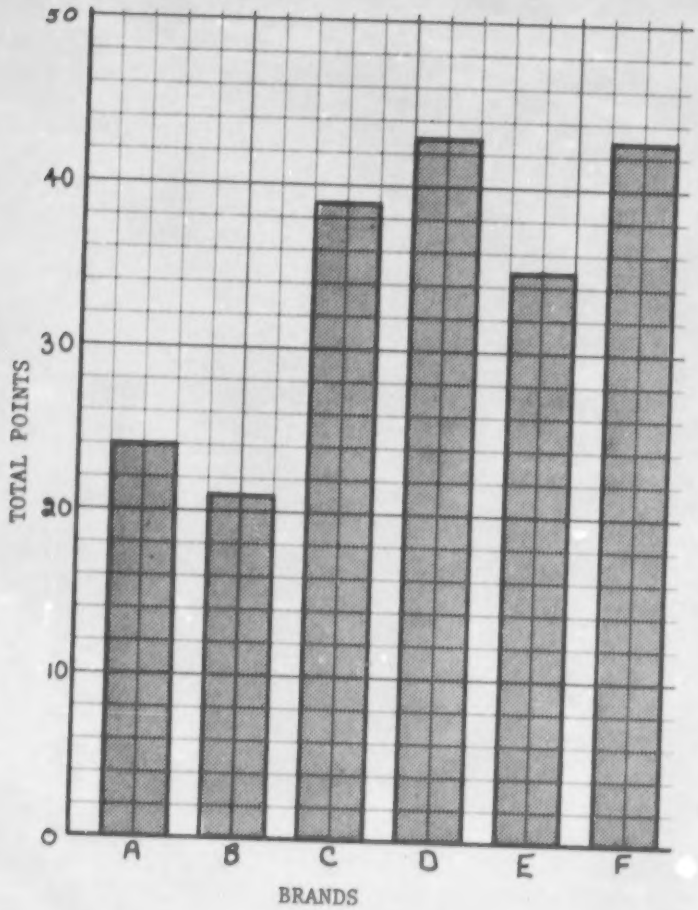


Figure B5-5

sults of the survey showed that 31.2% of the students preferred cheese popcorn while 20.8% preferred caramel. However, the taste test showed that 42.2% of the students liked the taste of caramel popcorn best while only 21.8% liked cheese popcorn the best. The class drew large bar graphs of the results to display at a science fair. (From log by Erwin Drechsler.)

The kindergarten class investigating cereal ran a taste test within their class on three cereals and made tally marks on a chart to record which cereal the children chose as the best. The teacher said that people sometimes make a picture of their information and then conducted a skill session on simple bar graphs. The next day, the children made a bar graph of the number of ounces of cereal in each box, which they titled "How much oz." (From log by Susan Marquis.)

A fourth-grade class in Monterey, California, performed tests on paper towels and rated the performance results in words, i.e., excellent, very good, fair, poor. They encountered difficulty when they tried to determine an overall rating for the paper towels based on the results of four tests. They decided that on their future tests they would rate brands numerically for easier averaging. (See log by Diane Sammet.)

In the meantime the kite string group has been testing the different strings for strength by tying science books together with the string and using a two-foot length of the string to lift the books off the floor. Starting with two, they keep adding science books, one at a time, until the string breaks when they try to lift them. They record the maximum number of books that the string will lift without breaking. Their results are--

Brand A	5 books
Brand B	3 books
Brand C	3 books

They agree that the results of their test show that brand A is much stronger than brands B or C.

We tested the thick string to see if it could hold a person on a chair, and it could hold.

We tested all the strings to see how much weights each different kind of string would hold.

From a student's Consumer Research log, William Kucher's class, grade 5.

When the kite string group reports their results to the class, the teacher asks how they could tell which string is stronger, B or C. The group replies that they could use smaller books so that a smaller difference in strength would show up. One student says that a sudden jerk on a string is what usually makes it break. Two students in the group decide to test the strength of the strings by using jerks. They hold one end of the string firmly on a desk and from different heights drop a book that is attached to the other end until the string breaks. Their results are--

	Height of book drop
Brand A	45 cm
Brand B	10 cm
Brand C	8 cm

The fifth-grade class testing kite strings first tried to test for strength by breaking the string with their hands. They then performed some trial tests by pulling a desk and a chair with the strings. Finally, they decided to test for strength by using various barbell weights. After a class discussion revealed that not all of the information had been written down, a chart was made on the board for the different groups to use. One girl then noticed that her group's medium string would not support the five-pound weight while that of another group would. The groups compared their methods for testing and then agreed to use the same method. (From log by William Kucher.)

One group of fourth-grade students in Monterey, California, compared the absorption power of six brands of sponges. After the first test was completed, they realized that they had not been consistent in their testing procedure. Performing the test again, the group made the following improvements: (1) they equalized the volume of the sponges by trimming the larger sponges to the exact size of the smallest; (2) they used the ounce rather than the quarter-cup markings on the measuring cup in order to measure more accurately the amount of water squeezed from the sponges; (3) they standardized the amount of time the sponges were soaked in water. After the third trial, the students were

finally satisfied that they had consistently tested all brands and that their tests were valid. (See log by Diane Sammet.)

The teacher asks the students testing kite string strength if they think they would get the same results if they tried again. The two students agree to try the test ten times with each brand. The results in centimeters are shown below.

Brand A: 36, 50, 32, 42, 38, 41, 47, 35, 40, 42
Brand B: 6, 7, 12, 8, 8, 9, 13, 15, 9, 10
Brand C: 8, 10, 7, 5, 9, 11, 6, 5, 9, 8

The teacher then shows them how to put the numbers for each brand in order from smallest to largest to find the median number. The results are as follows:

median = 40½
Brand A: 32, 35, 36, 38, 40, 41, 42, 42, 47, 50

median = 9
Brand B: 6, 7, 8, 8, 9, 9, 10, 12, 13, 15

median = 8
Brand C: 5, 5, 6, 7, 8, 8, 9, 9, 10, 11

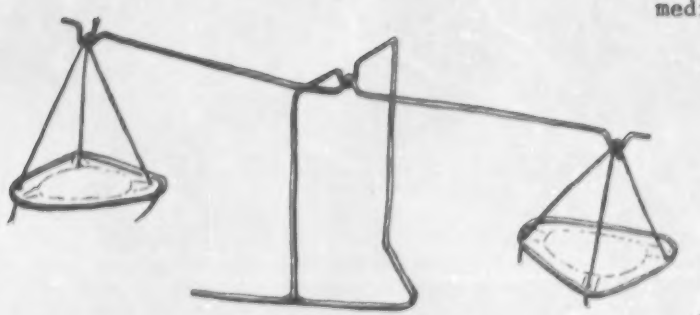


Figure B5-6

The students agree that brand C is the weakest string because it broke when the books dropped a median of 8 centimeters compared to a median of 9 centimeters for brand B and 40 centimeters for brand A.*

The rest of the string group has decided that they have to find out whether brand A is just as light as brands B and C. They agree that they can't compare the weights of the rolls because they contain different lengths of string and may also be wound on different weights of tubes. In discussing the problem with the class, someone suggests using an equal arm balance. The group makes a sketch of a balance (see Figure B5-6) and goes to the Design Lab to construct one.

After they have built their balance, they discover that it isn't sensitive enough to show a difference in weight

*Students in older groups could make a q-q graph of the results for brands B and C to see if there are other significant differences.--ED.

Tuesday March 13, 1973

We tested 10 pounds on the medium string dry and wet It didn't hold either way. Then we tested 5 pounds on the skinny string dry and wet. When the skinny string was dry it held 5 pound in 3 min. When the skinny string was wet it held 5 pounds in 4 min. Our conclusion was that the skinny string held longer when the string was wet. We also tested which string would fly the highest by putting all three strings by the heater. The skinny string flew the highest then the medium string then the thich string. When the string was wet it flew lower than it did when it was dry.

From a student's Consumer Research log, William Kucher's class, grade 5.

when short lengths of string are used. They then measure ten meters of each brand of string and find that brand A is heavier than brand B and that brand B is about the same weight as brand C.

To get more precise results, they balance each brand with small sheets of paper. They find that it takes four sheets of 12½ cm x 7½ cm paper to balance brand A, three sheets to balance brand B and three sheets to balance brand C. To find the difference in weights between B and C, they use smaller sheets of paper, 3 1/8 cm x 3 3/4 cm. They find that it takes twenty-four sheets to balance 100 meters of brand B string, but twenty-three sheets balance 100 meters of brand C string.

One group in a third-grade class in Watertown, Massachusetts, constructed a device to hold a felt-tip marker while testing the number of strokes it could make before going dry. Rubber band and Tri-Wall pieces were attached to the chassis of a toy car. The marker was wedged in place and the car rolled back and forth over a piece of paper. (From log by Barbara Norton.)

Students in a combination fourth- through sixth-grade class in Lansing, Michigan, were faced with the problem of determining the amount of water in various cans of corn. They realized that if they weighed the cans, they would get the total weight of the can, the corn, and the water. At first they thought of using plastic cups because "plastic cups don't have any weight." Finally they separately weighed the cup and the cup filled with the water from a can of corn, subtracting the cup's weight from the total weight to get the weight of the water. (From log by Elnora Martin.)

The potato chip group decides that they should test the amount of greasiness in the different brands. In discussing how to test, they agree that they have to use equal amounts of potato chips. After seeing the balance constructed by the string group, they decide to make a similar one to weigh the potato chips to use in their test. They then crush the amount of potato chips weighed for each brand in a separate paper towel and notice that the size of the grease spots varies.

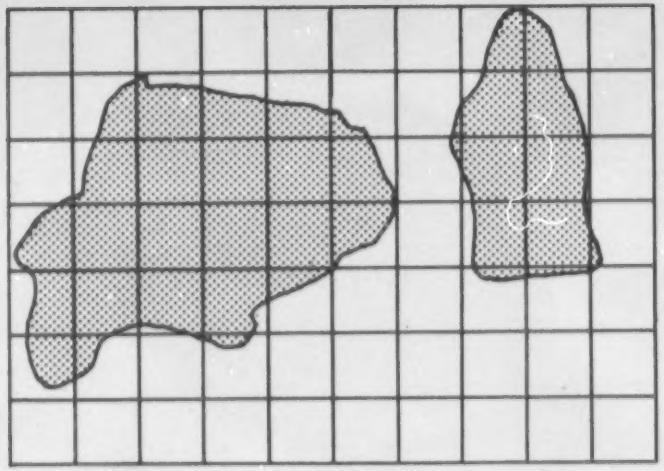


Figure B5-7

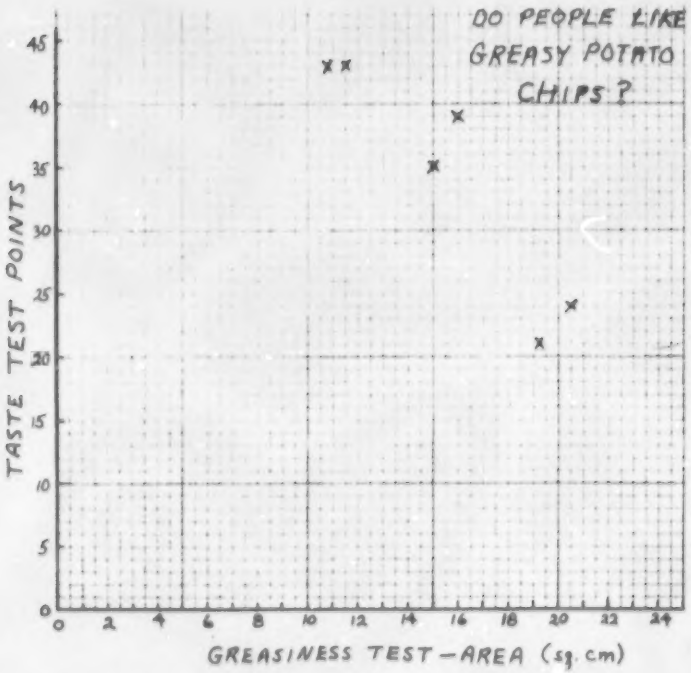


Figure B5-8

In a class discussion on the results, the idea of measuring the areas of the spots comes up. Since all the spots are irregular, the teacher suggests that they mark a grid of centimeter squares on a transparency and then count the number of squares covered with grease. (See Figure B5-7.) They agree that they will estimate to quarters of squares. Their results are--

Brand A	20 1/2 squares	Brand D	11 1/2 squares
Brand B	19 1/4 squares	Brand E	15 squares
Brand C	16 squares	Brand F	10 3/4 squares

Some students point out that students must not like greasy potato chips because the greasiness ratings are in almost the same order, from least greasy to most greasy, as the results of the taste test ordered from liked the most to liked the least. To find out how to show this on a graph they refer to the "How To" Cards. With the help of the teacher they make a scatter graph showing the results of both tests (see Figure B5-8). They see that the points are higher on the left side of the graph than on the right side.

The potato chip group examines their list of characteristics of potato chips. They agree that they have tested the three most important characteristics, since potato chips getting stale quickly probably wouldn't be crucial in the lunchroom where so many are eaten.

The group collects all their graphs and presents them to the class. They recommend that the class try to get the lunch supervisor to buy brand F. They argue that it costs slightly more than brands A and B, but that it tied with brand D (which costs more) for top place in the taste tests and was lowest on the greasiness test. The class agrees with the group's recommendations and suggests that they invite the lunch supervisor to the class so that she can see their data.

The class investigating kite strings discovered that the different tests were giving different results. They decided to rank the strings in order after each test and at the end decide which tests were more important. (From log by William Kucher.)

Children who had been working on Consumer Research in a fourth-grade class in Washington, D.C., became

involved in a discussion concerning the safety of the toys they had received for Christmas. Several students wrote for free government pamphlets listing banned toys. The teacher took advantage of their proximity to Philadelphia by inviting a representative from the Bureau of Product Safety to visit the class. The representative brought banned toys and asked the children to inspect them for possible hazards and then to find the toy on the banned list. One boy felt that the notebook he used posed a possible danger because the edge of the spiral had scratched him badly. He filled out a consumer complaint form and mailed it to the Bureau of Product Safety. (From log by Ruth Winston.)

The kite string group presents its data to the class and recommends that people buy brand A if they want a strong and light kite string. They say that it costs a little more than brand B, but less than brand C, and is much stronger than either of them. They say that it is also plastic-coated and wouldn't soak up water if it rains. One boy says that he was able to buy a roll of brand A at a store for only thirty-five cents, not the thirty-nine cents paid by the group. Everyone agrees that especially at the reduced price, brand A is the best buy. The class suggests that the group make a public address announcement about their recommendation since the kite flying contest is only a week away. They also urge the group to put their data in the school newspaper.

Students in one second-grade class in Arlington, Massachusetts, decided to do comparative shopping for lollipops in several local stores. In order to keep track of the data they gathered, they realized they would need some sort of information sheet. They designed a "research paper" with columns for store name, available brands, and cost per brand. (See log by Dorothy Galuzzo.)

One group of eighth-grade girls in Athens, Georgia, tested shampoos. They wrote to several manufacturers and requested information about their particular brands. One company sent them a letter and

an information sheet which gave a brief history of shampoos, the performance characteristics a shampoo should have, and answers to some of the questions most frequently asked about shampoo. The girls were elated to find that they had performed some of the tests for the important shampoo characteristics, such as amount of suds and irritation to skin. They later wrote to a manufacturer of a shampoo that they felt dried the scalp and could cause skin irritation. (From log by Sherry Malone.)

The following week the lunch supervisor visits the class and says that she'll see whether the potato chips the class recommends come in a large enough size to buy for the cafeteria. She also tells the class about state regulations for the nutritional balance in the meals served. The class becomes interested and decides to work on the Eating in School challenge next.

6. QUESTIONS TO STIMULATE FURTHER INVESTIGATION AND ANALYSIS

- What brand of _____ should we buy?
- What have you bought that was not too good?
- How do you or your family decide which product brands to buy? Do you consider cost?...usefulness?...availability? ...advertising?
- How can we determine whether one product brand is better than another?
- What does the price of a brand tell you about its quality? How can you prove to someone else that the price does or does not show how good the brand is?
- How can you compare the prices of different brands of the same product? Why should you calculate the price per length, per ounce, etc.?
- What are the manufacturer's claims about the product?
- What are the most important properties to test?

Tasting different brands of popcorn.

- How can you find out which product brand people like best?
- What tests could you make on your product? Will you be able to conduct the tests in the Design Lab or classroom?
- What will your test procedures be? What supplies do you need to conduct the tests?
- Which of your tests show that your product is good for _____(use)_____?
- How can you keep a record of your test procedures and results?
- How can you make a picture of your test results?
- What things affect your test? Why should you make sure that only one thing changes at a time?
- How can you make sure that your test is the same for each brand?
- Why might it be useful to do a test more than once? If you do the same test several times, what do the results tell you about your accuracy?...your test?...your product?
- Why might it be useful to test more than one sample of each product brand?
- Who might be interested in your findings? How can you inform them?
- How can you display your data so that it is easily understood by other people?

C. Documentation

1. LOG ON CONSUMER RESEARCH

by Dorothy Galuzzo*
Hardy School, Grade 2
Arlington, Massachusetts
(April-June, 1973)

ABSTRACT

This second-grade class initially discussed why they liked or disliked products they had purchased. They listed various products they would like to test, and for their top three choices they determined important properties they should consider. After voting to test lollipops, the students devised a "research paper" on which they recorded information on brands, quantity, and quality of lollipops at several local stores. The class purchased ten brands of lollipops and compared prices by a simple division technique. Using a rating scale of one to ten, the children ranked the lollipops according to how well they were wrapped and whether the stick might be dangerous. They began displaying their ratings on a master chart, but when this procedure became complicated, they decided to work with fewer brands. The class eliminated the five least-favored brands of lollipops and continued working with the top five. Based on their ratings for taste, wrapping, number of flavors, danger of stick, and cost, the children judged Charms as the best overall brand of lollipop.

For our initial discussion on Consumer Research, I asked my second graders to bring to class items they had purchased, including things they both liked and disliked. Then, as the children told why they liked or didn't like a product, I wrote their responses in two lists on the board:

Disliked

dangerous
hard to put together or use
too many parts
guarantee not kept
didn't do what it said
poorly constructed

*Edited by USMES staff

Liked

acts like the "real" thing
unbreakable
color
souvenir (memories)
wear
pretend
did something
moving parts
didn't have to be shared

The children felt that the most important reason for liking an object was that it didn't have to be shared. The objects they most disliked were ones that were dangerous or ones that didn't live up to the claims on the labels.

At our next session, which was held after spring vacation, we started by reviewing our previous discussion. Then I wrote the word *research* on the board, and the children offered the following definitions:

"If you lost something and you look for it, you would re-search it."

"Research means when you test things."

"When you make new things that you never thought you could make."

"It means when you study things."

We next discussed the word *consumer*, which I also wrote on the board. I suggested that the children had been consumers at lunch that day when they were eating or "taking it in." When I asked what they had been consuming during reading hour, they replied, "Words," and they agreed that at that moment they were consuming air. I pointed out that when we tested products, we would be doing *consumer research*. The children felt that they had already begun to be consumer researchers when they had discussed why they liked or disliked products they had bought.

Our discussion turned to purchasing and testing products. I reminded the children of my experiences at an USMES workshop where I had tested crayons on the basis of color appeal, strength, and price. We then considered what thoughts would go through the minds of two ladies, each having fifty dollars

to spend for a new coat. The children came up with the following criteria for selecting a coat: fabric, warmth, color, waterproofing, strength, and price.

This discussion led me to challenge the class to select a product and compare several brands to determine the best one. The children initially suggested testing the following products:

paper	clay	paper weights
glue	crayons	paper plates
pencils	elastics	jewelry
paints	paper cups	paper clips
tape	pancakes	felt-tip markers
books	lollipops	

At the following session they added pens and music to the list.

To choose one product for testing, we decided to vote. Everyone listed first, second, and third choices on a slip of paper. Then, taking turns at the board, each child placed a white tally mark next to his/her first choice vote, a blue mark next to the second choice, and a yellow mark next to the third.

When the voting was completed, the students eliminated items receiving three or fewer votes. The following three products remained on the board:

	first	second	third	total
clay	3	7	1	11
lollipops	4	2	2	8
felt-tip markers	2	2	4	8

We concluded that lollipops had been selected first most frequently, clay was chosen second most frequently, and felt-tip markers was the most frequent third choice.*

*The children could also have used a weighted voting procedure by assigning weighted values to each place vote; for example, a value of three points to each first place vote, two for second place, and one for third. This would give an overall score for each product, with the highest score belonging to the product that would produce the greatest group satisfaction.--ED.

When we discussed important factors to consider before buying one of the three products, the children immediately mentioned cost and quality. Quality, they felt, meant whether a product was good or bad. When one student added that nutrition could determine quality, I asked him to explain.

"How much [*sic*] vitamins are in it and how good it is for you."

"Is that a factor when we speak about clay?" I asked.

"No," he said. "Only lollipops."

"Why would you want to buy something that didn't have vitamins once in a while?"

"For the taste," agreed the students.

"Is that important for clay?"

"No," they said.

"For markers?"

"No."

Vitamins then weren't an important consideration for clay or for markers, but, the children said, how well these products worked and how "playful" they were should be considered. Other factors that applied to clay were flexibility, how fast it hardened, and stickiness. When buying markers, the children said that they expected them to write well, to last, and not to dry out. For lollipops, they agreed that important considerations were potential tooth decay and whether the sticks might be dangerous.

I labeled the three products with letters, *A* for clay, *B* for lollipops, and *C* for magic markers. We continued discussing important factors to consider about the products, and I listed each factor and the corresponding letter(s) on the board. At the end of our discussion, our list looked like the one below:

cost--A,B,C	stomach (calories)--B
nutrition--B	dangerous (swallowed stick)--B
taste--B	writes--C
works well--A,C	lasts--C
playful--A,C	dries out--C
flexibility--A	stickiness--A,B
hardened--A	cavities (sweetness)--B

At our next session the children reported that clay would be expensive to purchase and that few brands were readily available since only two stores in our neighborhood sold it. Therefore, our products were limited to lollipops and felt-tip markers. When the children voted, they decided, eleven votes to three, to test lollipops.

With our product selected, the children held a brainstorming session and listed the following ideas for lollipop tests:

Stickiness.
How long it would last.
Cost per lollipop.
Taste.
Number of flavors.
Condition they were in.
Do they get stale?
Amount of sugar. (Will we buy it if it might give some people cavities?)
Danger of stick; candy hardness.
Do they stain?
Are all flavors in packages appealing?
Are they well wrapped?

When we discussed where to purchase different brands of lollipops, the children selected five local stores where they regularly bought candy. They eliminated the local wholesale store because, as they explained, "Kids don't go there to buy candy." Agreeing that it would be difficult to remember details about each store's supply of lollipops, the children devised a "research paper" on which they would record the following information:

How many brands?
Do they have a good supply?
Is it (lollipop) in pieces?
Cracked?
Broken stick?
Not wrapped?

To make our purchases, I accompanied the class to the five local stores they had selected. At each store, a small group entered, bought lollipops, and recorded the necessary information on their research papers.

At the next session we discussed the data they had collected and looked at the lollipops they had purchased. Each of the small groups reported to the class; for example, two girls reported that they had purchased a thirty-nine-cent package of Schrafft's lollipops. They explained that while the store carried a good supply of this brand, many of the lollipops were cracked and had broken sticks.

After all the reports had been given, I asked the class

which tests should be performed first and which could wait for later testing.

"We want to taste them first," said one student.

"If we go about tasting them first," I responded, "how will we find out if they were sticky, how long they lasted, and how much they cost? Are there some things we have to do before we start eating them?"

One student replied, "We have to find out the cost of the lollipops."

"Why?" I replied.

"Because if we eat them all first," he said, "we won't be able to count them, and we have to see how much we get for the money."

Another student proposed, "We can eat some and save some."

"Some things you have to do after you taste them," said a third child. "You don't have to eat them all, but you have to taste them to see if they stain or if they're sticky."

When the children who were ready to begin taste tests immediately realized that this would interfere with other tests, they agreed to delay eating the lollipops until later.

We then worked together to categorize each test according to whether it should be conducted before, during, or after the taste test. The children made the following decisions:

> Count (number of lollipops per package)--before
> Cost--before
> Stickiness--during
> Number of flavors--before
> Do they get stale?--after
> Danger of stick--during
> Are all flavors in one package appealing?--before

We agreed to conduct the four "before" tests at our next session. However, since most of the children were so eager to begin taste tests on the lollipops, I decided to pass out two brands and to replenish our supply before the next session. Two students tallied the taste preferences of the class at the board. In this preliminary test, Dum Dums received fifteen votes and Schrafft's four.

When we began a cost analysis at the next session, I divided the children into groups and distributed a different brand of lollipop to each group. (Some brands came in packages and some were sold individually.) As each group reported on the number of lollipops and the cost of their brand, I recorded the information on a chart as shown on the following page.

Brand	No. of lollipops	Cost of package
Schrafft's	23	39¢
Charms	2	10¢
Dum Dums	39	39¢
Dingbats	2	10¢
Tootsie Pops (small)	3	10¢
Tootsie Pops (large)	1	5¢
Candy Cupboard	3	10¢
Lil's	1	1¢
Jelly Top Bubble Gum	1	10¢
Big Mouth	1	10¢

I then presented the problem of finding the cost per lollipop. "If you get thirty-nine in a package and they cost thirty-nine cents, what do you know?"

The children correctly answered, "They each cost one cent."

But no one knew the answer to my next question: "How much would one Schrafft's lollipop cost if twenty-three of them cost thirty-nine cents?"

To solve this problem, I asked one child to draw on the board enough circles to represent the twenty-three lollipops. Then, following my directions to distribute thirty-nine dots as evenly as possible among the twenty-three circles, the child drew the following picture:

(The twenty-three circles represented the twenty-three lollipops and each dot represented one cent.)

I told the children to look at the picture, and I asked them how much each lollipop cost. Some students said one cent; some said two cents. I then asked for a show of hands for each price, and only a few children raised their hands for one cent. Most students agreed with two cents, and so I asked, "Do they all cost two cents?"

"No," replied one child. "You get some for one cent."

"Or do they cost maybe a penny plus a little bit?" I asked.

Most of the students said yes, but one child spoke up, "You can't split a penny."

"That's a good point," I said. "Can you go into the store and give them a penny and a half for this lollipop?"

The children agreed that splitting a penny wasn't possible. Merchants usually wouldn't let customers open packages to buy only one or two lollipops. We agreed to record the price of each Schrafft's lollipop as "one cent plus."

We returned to our price and quantity chart to continue figuring the cost per lollipop for each brand. Some of the calculations were simple; for example, Charms were two for ten cents, and the children quickly said that each one cost five cents. Dum Dums were one cent each, and Dingbats five cents each.

When we got to Tootsie Pops at three for ten cents, I drew three lollipops on the board. One of the children drew in the dots representing ten cents as shown in the drawing below:

The class agreed that the store charged an extra penny for one of the lollipops. They also thought that if a customer bought only one lollipop, the store would probably charge four cents. The children concluded that for Tootsie Pop and Candy Cupboard brands, both of which sold at three for ten cents, each lollipop cost three cents plus.*

With the cost per lollipop calculated, the class next selected the best-wrapped brand. To study the different wraps, the children walked around a table on which all the brands were displayed. Then they nominated three brands for best-wrapped and voted for their first and second choices by closing their eyes and raising their hands. The result of the vote is shown below:

	1st Choice	2nd Choice
Big Mouth	5	2
Schrafft's	4	6
Charms	4	4

*The children might compare the cost per lollipop for the various brands by constructing a slope diagram. By comparing the slopes of diagonal lines, the children could determine relative costs per lollipop. See "How To" Cards and Background Papers.--ED.

Instead of having the children vote for third choices, I told them we would figure it out mathematically. I changed the appearance of the chart to help them.

	1st Choice		2nd Choice		3rd Choice		
Big Mouth	5	+	2	+	6	= 13	(Number of children
Schrafft's	4	+	6	+	3	= 13	voting)
Charms	4	+	4	+	5	= 13	
	13		12		14		

First, they filled in the blanks for the third choices. Then they added each of the columns for first, second, and third choices and discovered that someone had forgotten to vote for a second choice. That made one too many votes in the third choice column.

When we had the chart correctly filled out, the children interpreted the data. Big Mouth was the best wrapped, and Schrafft's and Charms were both only one vote behind for first place. Since Schrafft's received six votes for second choice and Charms received only four votes, Schrafft's was chosen for second best wrapped because its overall rating was higher.*

Several days later, each child filled out a chart on which the following information was recorded for each brand:

1. cost per lollipop
2. number of flavors
3. how well wrapped it is
4. how dangerous the stick is

The children had previously voted on the three best wrapped brands, but they decided to repeat this test and include all brands. Each brand was subjectively awarded one to ten points; the higher the number, the better the wrap. They also subjectively awarded each brand with one to ten points on the danger of the stick; the higher the number, the less dangerous the stick.

*Again, the children might have assigned weighted values for first, second, and third place votes.--ED.

At the next session, we began to tabulate the results from the children's individual charts. I first drew the following master chart on the board to show how many points the children had awarded to each brand for its wrapping:

	Number of Points									
Brand	10	9	8	7	6	5	4	3	2	1
Schrafft's										
Charms										
Dum Dums										
Etc.										

We worked with one brand at a time. As I called out each point value, the children who had awarded the brand that number of points stood up to be counted. The entire class helped with the counting, and we placed the appropriate number of tally marks in each column. A summary of the final tally is shown below:

Most 10s: Charms
Most 9s: Schrafft's
Most 8s: Dum Dums
Most 7s: Dingbats
Most 6s: Lil's
Most 5s: Big Mouth
Most 4s: Tootsie Pop (large)
Most 3s: Candy Cupboard
Most 2s: Tootsie Pop (small)
Most 1s: Jelly Topped with Bubble Gum

Filling in the master chart took us a long time. Some of the children had made mistakes in their individual charts; with ten numbers to record, they had accidently assigned the same number of points to different brands. Since the students felt that there were too many lollipops and too many numbers to keep track of, we decided to reduce the number of brands, which would mean working with fewer numbers. After making general observations about the lollipops, the children eliminated the following ones:

1. Tootsie Pops, both large and small, were not well wrapped.

2. Jelly Topped with Bubble Gum was made with bubble gum and lots of sugar, both of which are particularly bad for teeth.

3. Dingbats had only two flavors.

4. Lil's lollipops were generally unpopular.

After eliminating these brands, we were left with five brands to test: Charms, Schrafft's, Dum Dums, Big Mouth, and Candy Cupboard.

We continued tallying the results on number of flavors and danger of stick from the children's individual charts and found it much easier to work with a reduced number of brands. Eventually we compiled the following lists to show how each brand ranked in three different categories:

Best Wrapped	Largest Number of Flavors	Least-Dangerous Stick
1. Charms	1. Dum Dums	1. Big Mouth
2. Schrafft's	2. Schrafft's	Charms (tie)
3. Dum Dums	3. Candy Cupboard	Candy Cupboard
4. Big Mouth	4. Charms	2. Dum Dums (tie)
5. Candy Cupboard	5. Big Mouth	Schrafft's

The children then performed the final test--tasting the lollipops. Since only four of the five brands--Charms, Schrafft's, Dum Dums, and Big Mouth--had a flavor in common, Candy Cupboard was eliminated for this test. So that everyone could participate, I wrapped each brand of lollipop in cloth and broke it into pieces with a hammer. While the children tasted the different brands, I wrote the unit costs on the board so that we could compare taste with cost.*

Schrafft's	1¢+
Charms	5¢
Big Mouth	10¢
Dum Dums	1¢

The children noted that Charms lollipops cost more than Schrafft's or Dum Dums, and yet they tasted as if they contained less sugar. Big Mouth was the most expensive, but it contained bubble gum and sugar rather than "lollipop."

*In considering the costs of different brands, the children might compare the sizes or weights of the lollipops. For example, a more expensive brand could give a larger or heavier lollipop for the money and actually be cheaper.--ED.

The fourteen children participating in the taste test then voted for their first and second choices, which I recorded on the board.

	1st Choice	2nd Choice
Dum Dums	1	1
Schrafft's	4	4
Charms	4	8
Big Mouth	5	1

When the children considered first and second choices together, they decided that Charms was the winner because it was a strong second choice.

The following day the class looked at the results from all their tests and then chose Charms as the best overall brand of lollipop to buy. The ratings for Charms on the different tests are shown below:

Test	Rating of Charms
Taste	1st
Best Wrapped	1st
Largest Number of Flavors	4th
Least-Dangerous Stick	1st (tie)
Cost	2nd highest

2. LOG ON CONSUMER RESEARCH

by Diane Sammet*
Monte Vista School, Grade 4
Monterey, California
(November 1971-June 1972)

ABSTRACT

After spending a week researching the effectiveness and truthfulness of different advertisements, this fourth-grade class tested six brands of paper towels for (1) resistance to disintegration, (2) durability, (3) absorption, and (4) wet and dry strengths, and they rated one brand as the best overall. The students next formed eight committees, each to test a different product (batteries, sponges, seed and fertilizer, peanut butter, hand soap and cleansers, plastic wraps, ball-point pens, glues, and transparent tapes). After discussing the important properties of their product and deciding on test procedures, each group purchased supplies, did a cost analysis, and carried out tests, using the Design Lab as needed. Several groups made bar and pie graphs to display data. When the tests were completed, each group reported the results to the class and wrote an article for the school newspaper to inform other classes about their findings.

I began a class discussion of consumerism by asking my fourth graders why they or their families purchased particular product brands. The reasons mentioned by the children included habit, cost, desire to "try out" an advertised product, and need for a certain product. When the students expressed a particular interest in advertising, we decided to spend some time researching TV commercials, which they felt had a great impact on consumer choices. Over the weekend the students carried out the following activities at home:

1. tape-recorded TV commercials
2. copied commercials word-for-word on paper
3. cut out magazine advertisements

The next week the students shared their advertisements. They evaluated and compared commercials in terms of the truthfulness of the claims and the effectiveness of the advertising. After each ad was presented, those students who

* Edited by USMES staff

were familiar with the product in that ad compared their experiences in using the product. In general, the students were very objective in their analyses of which claims were fair and which were obviously exaggerated. After our discussion, one group of children unexpectedly offered to set up a bulletin board for displaying the advertisements that the students had copied and had cut from magazines.

Because several children had brought in ads about paper towels, and because all the children used paper towels at home, we decided to test paper towels as a class project. The students brought in towel samples from six different brands: Facelle Royale, Coronet, Lucky, Scott, Viva, and Kleenex. After a discussion about important properties of paper towels, the children agreed that their tests should answer the question, "What brand of paper towel is the most absorbent and wears the best?" They suggested five different tests to perform, and we drew a large chart on the chalkboard to record procedures and results. The children listed and gathered materials they would need and then divided into groups to carry out their paper towel tests which are described below.

Test 1: Disintegration

Samples of paper towels were soaked in water for forty-eight hours and then were carefully wrung out and laid on a table. The students studied them to see if any of the samples had started to disintegrate. None had, and so all the brands were given a rating of "excellent."

Test 2: Durability

While the towels were still wet, the students scrubbed them on a rough surface (an old plastic game, 10" x 8", with a rough checkered surface) to find out how long each towel would last before tearing. The children carefully noted scrubbing times in seconds. The results ranged from three to ten seconds. ScotTowel lasted the longest and received a rating of "excellent." One brand was rated "very good," two "fair," and two "poor."

Test 3: Absorption

A dry sample of each towel was laid over the rim of a full glass of water. The children timed in minutes and seconds how long it took for the entire towel to become

completely saturated with water. The range varied from Coronet, which received an "excellent" rating (one minute, five seconds), to Kleenex, which received a "very poor" rating (six minutes, twenty seconds).

During the testing, a few students argued that the *longer* the towel took to absorb, the better, because that meant the towel was thicker and would eventually absorb more water. The minority was shouted down by those who contended that the main function of a paper towel was to absorb quickly.

Test 4: Strength (Dry)

A full glass of water was turned upside down onto an outstretched dry towel to test whether the towel would tear. Only the Lucky towel tore.*

Test 5: Strength (Wet)

Two children pulled on either side of a wet towel to find out how quickly each brand would tear. The class decided to ignore the results of this test when several students pointed out that it didn't prove anything. In addition, all the towels tore very easily.

* * * * *

When the tests were completed, the children had difficulty trying to average the ratings since the brand performance had been rated in words.** After much discussion, they agreed that Scott had the best overall performance and Lucky the poorest. They decided that the next time they performed several tests on a product, they would rate by number rather than by words.

An important criterion, cost per job, was missed since the students brought in only samples of towels, not entire

*The children could be asked whether they thought this test was as relevant to the conventional use of towels as other tests.--ED.

**The students could have averaged the test results by assigning a point value for each rating, e.g., 4 points for "excellent," 3 points for "good," etc. The brand with the most points would be the best overall.--ED.

rolls. Several children offered to check the prices and the lengths of the rolls in a supermarket.

The class was very interested in testing other products, and so eight committees were set up, each composed of four children with differing abilities. After Christmas vacation I met with the chairpersons selected from each committee to outline methods for keeping order in their groups, for example, assigning work evenly and fairly, setting up testing procedures. I asked the committees to choose one product to test, and each group listed several ideas and then voted on a final choice. The children based their selections on (1) products they used frequently at home, and (2) testability of products. When a committee reached a decision, the chairperson reported to the class so that other groups wouldn't choose the same product. Eventually the groups decided on the following products:

1. batteries
2. sponges
3. seeds and fertilizers*
4. soaps and cleansers
5. plastic wraps
6. ball-point pens
7. glue
8. transparent tapes

We next discussed the unwieldiness of all eight committees working simultaneously during every session and decided that only two or three groups would actually perform tests at the same time.** The other groups could continue with data analysis or other related activities.

The class met in groups to make plans. In each group, the children listed questions they had about the product they would test. For example, the Battery Group wanted to know--

1. Which brand lasts the longest?
2. Which brand makes a bulb burn the brightest?
3. Which brand is the most economical?

The group members shared ideas on testing procedures and then listed materials they would need. Each group also

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*The Seed and Fertilizer Group was forced to disband because of several disasters that prohibited further testing. The members changed products and became the Peanut Butter Group.--ED.

**To avoid disorganization, the class might limit the number of products they test at any one time to three or four.--ED.

started a file of index cards for recording information on testing procedures and results.

The students set up a bulletin board marked into eight sections so that each committee could display cards, pictures, graphs, and any other information about their products. The committees then made shopping lists based on the students' knowledge of brand names and allowing leeway for unexpected brands.

The following day we walked to a nearby shopping center to purchase products. Each group shopped independently and recorded the price of each brand they purchased. When we returned to the classroom, the groups filled out "cost analysis" cards for their files.

For the next several months, we worked on the challenge an average of one to two days per week. During a typical class period several, or all, of the groups tested their products simultaneously, either in the Design Lab or in the classroom.

During the testing the children showed an active interest in what other groups were doing, and they were willing to help other groups with their experiments. They were especially interested in the test results of other products and sometimes placed bets on the outcomes. As the testing continued, some groups thought of additional tests to perform on their products, and several students began writing and drawing advertisements for the best performing product brands. The activities of some of the groups are described in the following paragraphs.

BATTERY GROUP

This group did a very careful, precise job of testing, although the number of tests they performed was limited. They originally began with five brands of batteries, but when the supply of U.S. Army batteries from our Design Lab was exhausted, the group continued testing with four brands.

Test 1: Lifetime

The group made a circuit for each brand of battery, using one wire, two pieces of tape, and a flashlight bulb (Figure C2-1). They recorded the exact time in hours and minutes when the circuit was connected. Each group member took one circuit home at the end of the school day, watched it, and recorded the time when the light went out. Fortunately, the circuits had been connected early enough in the day so that

Picture of Battery with wire

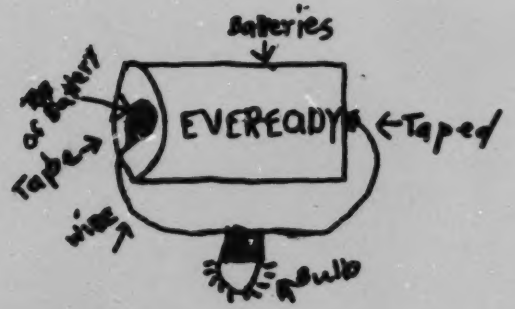


Figure C2-1

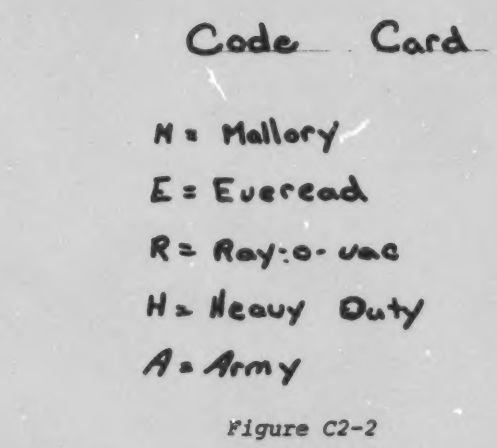


Figure C2-2

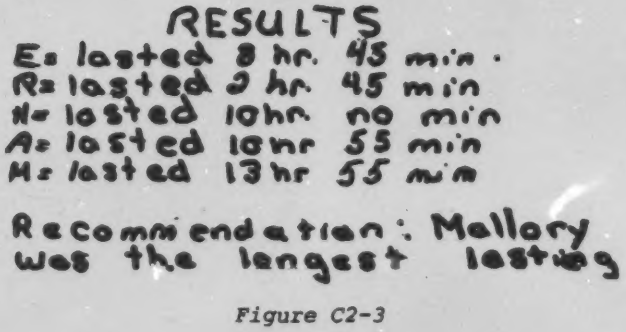

RESULTS
E= lasted 8 hr. 45 min.
R= lasted 2 hr. 45 min
H= lasted 10hr. no min
A= lasted 10hr 55 min
M= lasted 13hr 55 min
Recommendation: Mallory was the longest lasting

Figure C2-3

when the bulbs went out in the evening, the students were still awake. The children had been worried about this problem and were quite relieved.

The next day the group figured out how long each battery had lasted in hours and minutes and reported the results to the class. Figures C2-2 and C2-3 show the results of the lifetime test.

After their group report, I gave a short presentation on graphing and the uses of different kinds of graphs--bar graphs, line charts, and circle graphs. The group depicted their results on a bar graph, first choosing inch-square graph paper with each square representing one hour because they wanted their bars to "show up." When they had to tape two pieces of graph paper together to fit the bars on, they realized that half-inch square paper would have saved them time and paper. For the card file, the students used quarter-inch square graph paper (Figure C2-4).

Test 2: Lifetime in Flashlight

The students placed a new pair of batteries in each of four flashlights. Following the same procedure used in their first lifetime test, they noted the time when the batteries were installed and the time when the flashlight bulb went out. In this situation they found that Eveready had the longest lifetime. (Figure C2-5 shows the bar graph drawn for the card file.)

Test 3: Strength

To test the power of the different brands of batteries, the group used flashlight bulbs and sheets of yellow tissue paper. They lighted the bulbs with each brand of battery and then counted the number of sheets of paper needed to eclipse the bulb. The students reasoned that the total number of sheets would be a measure of the brightness of the bulb and, consequently, of the power of the battery.

The group first prepared more than 100 five-inch square sheets of paper. Darkening the room and shining the flashlight into one end of an open, foot-long box, they held up successively greater numbers of sheets of paper in front of the box. They counted the sheets of paper one by one for the first battery, but thereafter they clipped the sheets together in bundles of twenty. The other students in class decided when the light from the bulb could no longer be seen. The group graphed their results on one-quarter inch square

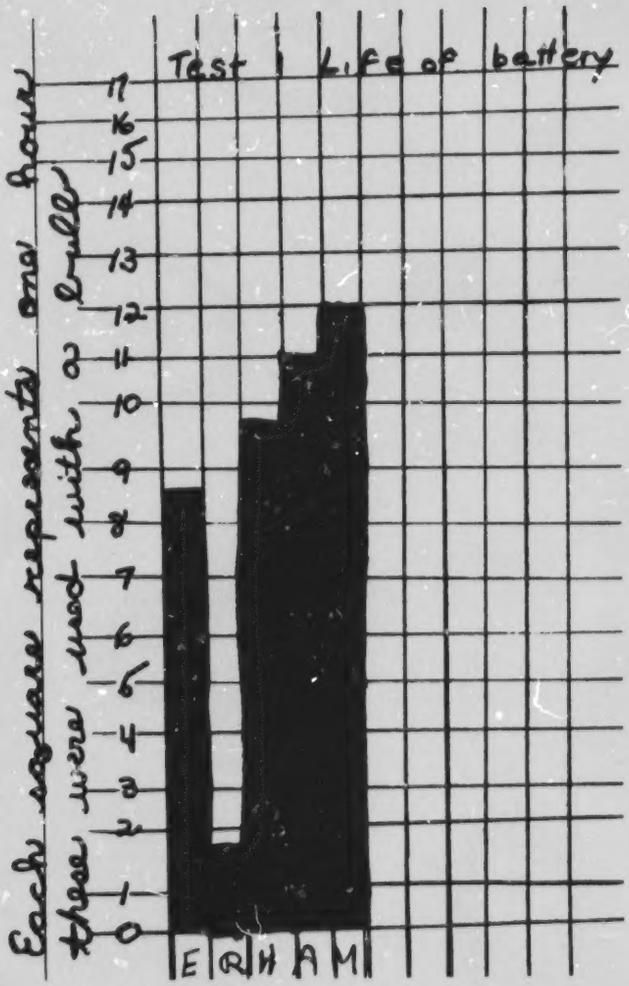
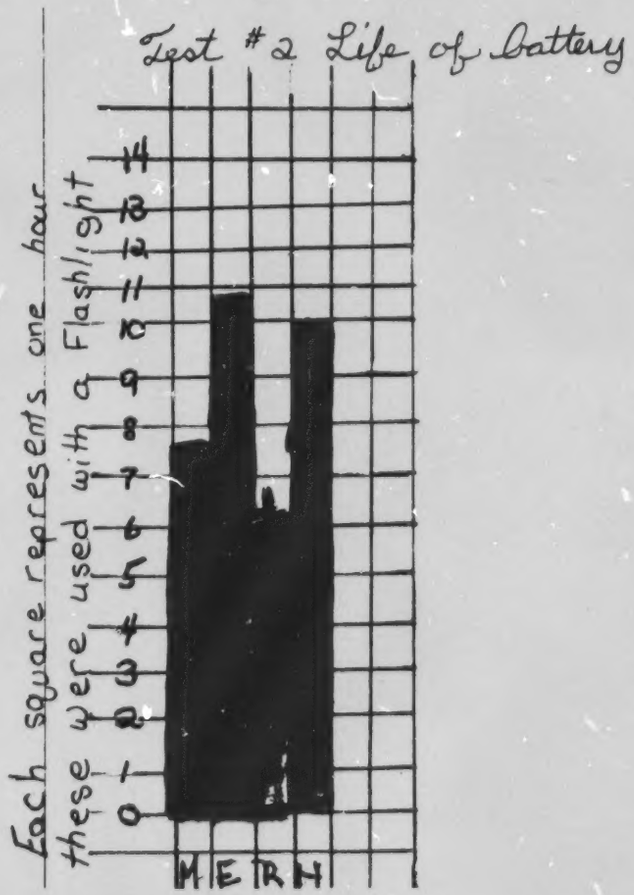


Figure C2-4

Figure C2-5



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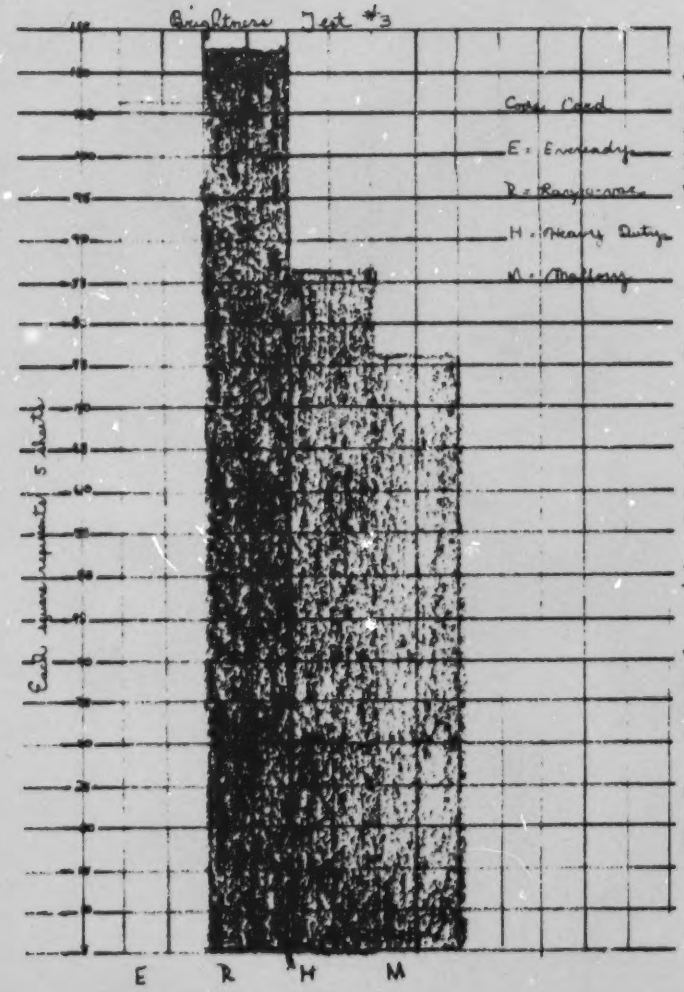

Figure C2-6

graph paper (Figure C2-6) and rated the batteries on an index card for their permanent file.

Conclusions:

When the tests were completed, the group computed the overall score for each battery. They found that the results were very close although Eveready had a slight edge over the other batteries. In their final recommendation, the students noted the closeness of the scores and pointed out that while Eveready scored best in their tests, two other brands that were less expensive had performed almost as well.

* * * * *

SPONGE GROUP

The Sponge Group compared the properties of six sponges. Four were different brands, and the other two were duplicates of two brands but with different qualities; for example, one sponge had an abrasive surface on one side, the other of the same brand did not.

Test 1: Absorption

Each of the six sponges was soaked in a coffee can filled with water and the water was then squeezed out into a measuring cup. The amount of water that each sponge held was recorded, and the sponge was rated according to its absorption properties.

When the students realized that they had not been consistent in their procedure, they repeated the test, eventually testing three times. On the reruns, the group made the following improvements:

1. They equalized the volume of the sponges by trimming the larger sponges to the exact size of the smallest. After the first test, the students decided that for a fair comparison, the sizes should be equal.*

*The appropriate size for the sponges could also have been determined by equalizing cost rather than volume.--ED.

SPONGES NAME	RATE	DATE	SOAKED ½ FOR 1 MIN ABSORBED
Scotch-Brite orange	4th	3/22/72	3 oz.
DuPont	3rd.	3/22/72	3 ¼ oz.
DuPont scrubsurfes	1st.	3/22/72	4 ⅓ oz.
3-M blue	5th	3/22/72	2 ¾ oz
O-CEL-O	2nd	3/22/72	4 oz
O-CEL-O lime	2nd	3/22/72	4 oz.

Figure C2-7

2. To measure more accurately the amount of water squeezed from the sponges, they used the ounce markings on the measuring cup. For the first two tests, the children had recorded the amount of water in quarter cups and had found few differences among the sponges.

3. They standardized the amount of time by soaking each sponge for thirty seconds.

After the third test, the students decided that their results were valid. They recorded the information in their card file and then displayed the results on a bar graph (Figures C2-7 and C2-8).

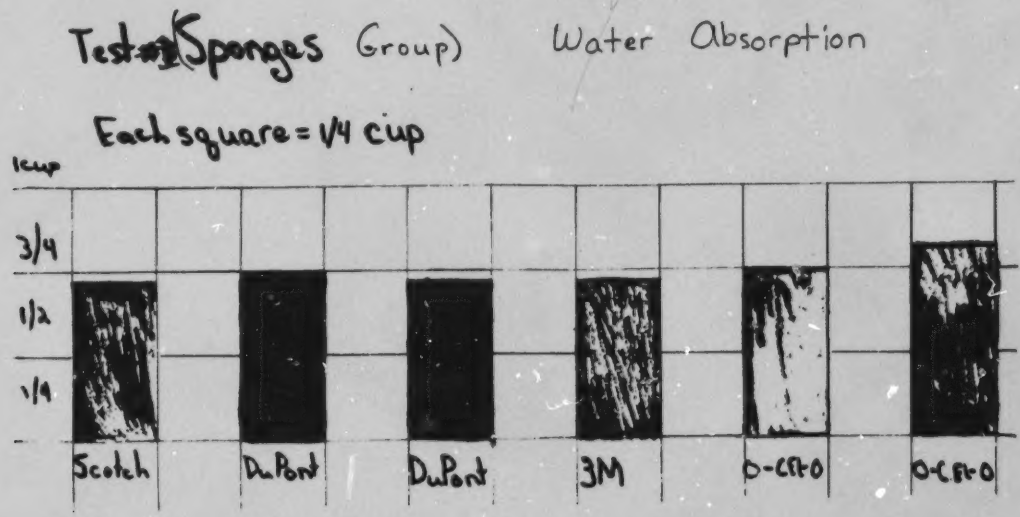

Figure C2-8

Brand	Rate	Time
Scotch-Brite	1st	4 sec.
DuPont	and	5 sec.
DuPont	4th	10 sec.
~~Nylonig~~		~~6 sec.~~
3M	2nd	5 sec
O-Cel-O	4th	10 sec.
O-Cel-O	3rd	8 sec.

Figure C2-9

Test 2: Lifetime (Durability)

Each sponge was scrubbed while wet on the rough surface of the game previously used in the paper towel test. The students used a stopwatch to time how many seconds elapsed before the first shred came off. Results were recorded on a file card (Figure C2-9).

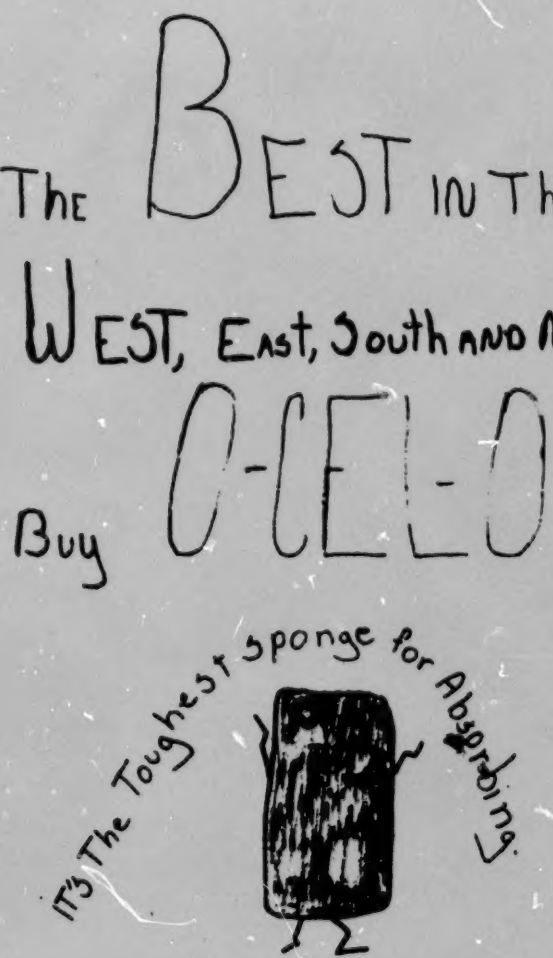

Figure C2-10

Test 3: Cleaning Power

The students prepared a board with six large circles on which they placed mud to dry overnight. The next day they scrubbed each circle with a different sponge for thirty seconds. The sponges were rated from one (cleanest circle) to six (most smeared circle).

Conclusions:

When the group tallied their test results, they found that four sponges tied for first place as most absorbent and most durable. Unfortunately, the results for the cleaning power test were lost and could not be used in tabulating the overall ratings. One student's advertisement for O-Cel-O Sponges is shown in Figure C2-10.

* * * * *

PLASTIC WRAP GROUP

This group provided some of our most successful testing operations. The children involved were eager to work and did a fine job. They were both imaginative in their testing and reliable in keeping records and tabulating data. They performed tests on five brands of plastic wrap.

Test 1: Mold

The children took slices of bread from the same loaf, wrapped each one the same way in a brand of wrap, and then labeled them. Three weeks later the group unwrapped each package and estimated the percentage of mold on the bread. They made circle graphs (Figure C2-11) with a section in green representing the percentage of mold, which they had determined by observation and mutual agreement. They also estimated the softness of the bread and rated each wrap numerically according to the amount of protection it gave the bread.*

*In practical terms, the rating could be reversed since the better the wrap holds in the moisture, the more mold will be produced. The children could also consider checking the correlation of softness and mold.--ED.

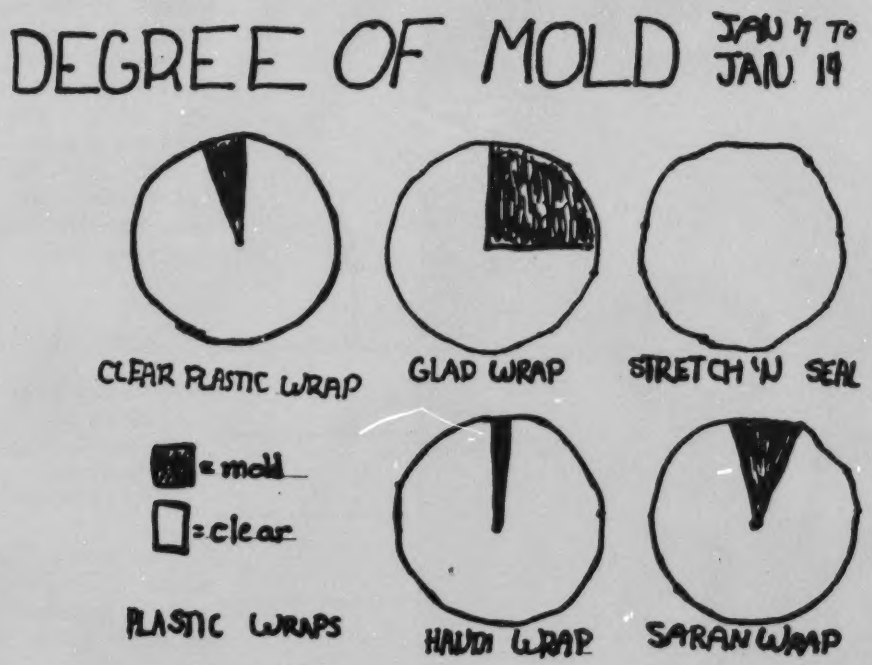

Figure C2-11

Test 2: Odor Retention

The group used this test to determine which brand of wrap would best protect a refrigerator and the other food in it from strong odors of wrapped food. They brought a yellow onion to class, cut it into five pieces, and covered each piece with a separate brand of wrap, labeled from A to E. The students then asked their classmates to smell each wrap and to indicate whether the odor of the onion was detectable. The committee studied the "How To" Cards on tallying and then tallied the results with marks in groups of five.

Test 3: Strength

The group measured a 12" x 5" piece of each of the five wraps and tested each one separately. Two children held the corners of an outstretched piece of wrap while a third child dropped four-ounce fishing weights onto the center from a

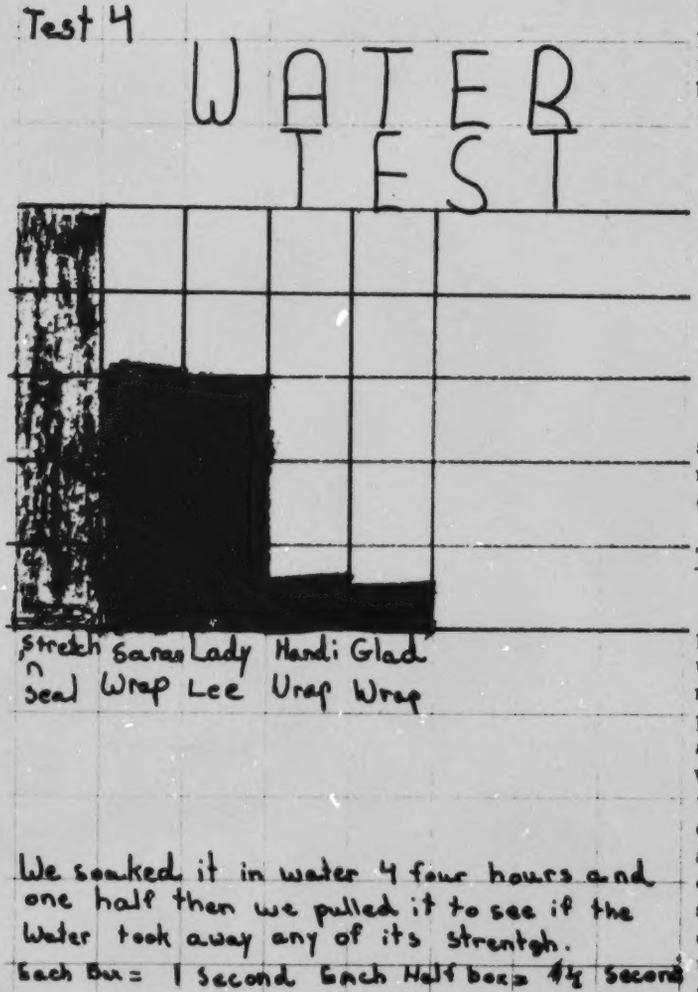

Figure C2-12

height of 1½ feet. (A height of four feet was tried at first, but all the wraps tore when the first weight was dropped.) For uniform testing, marks were made on the chalkboard to indicate where the wrap should be held and from what height the weights should be dropped. A fourth child tallied the number of weights dropped before the piece of plastic wrap tore. The other members of the class were very interested and gathered to watch the test. Several placed bets on the number of weights that could be dropped before the wrap tore. The results are shown below:

Brand of Plastic Wrap	Number of Weights Dropped	Strength Rating
Saran Wrap	12	1
Stretch 'N Seal	7	2
Handi-Wrap	1	4 (tie)
Lady Lee	4	3
Glad Wrap	1	4 (tie)

The group felt they had really discovered something, since Saran Wrap came out so far ahead. The group leader made a recommendation: "Tell your mothers to buy Saran Wrap or Stretch 'N Seal!"

Test 4: Underwater Test

The children thought it was important to know how well plastic wrap would withstand water because it is sometimes used to cover books in rainy weather, and at other times it might be used to wrap picnic foods for an ice chest. Equal pieces of wrap were labeled with masking tape and crayon and placed in a bucket of water for five hours. When the wraps were removed, the group first looked for any signs of tearing. Only one had split from the soaking, and it received an automatic rating of five. The students then used a stopwatch to note how long the other four soaked wraps could withstand pulling on both sides before splitting. Results were displayed on a bar graph (Figure C2-12). The children realized that this was a very subjective test and that it would probably have been more effective if they had actually wrapped food.

Test 5: Pebbles (Accident) Test

About one-half cup of small pebbles was placed in a drinking glass. A piece of each brand of wrap was placed over it.

The glass was then turned upside down to simulate an accidental spill. The children used a stopwatch to time how many seconds each brand of wrap held the pebbles and then represented the data on a bar graph.*

Test 6: Heat Test

Resistance to heat was tested on a hot day (95° in direct sunlight). The group placed a sheet of each brand of wrap on the lawn in front of our room for one hour. The committee then checked them for stickiness, condensation, and loss of body. The wraps were rated numerically from one to five with Saran Wrap receiving the best overall rating for heat resistance. (One test planned but not completed was to place the wraps in a freezer to test the effect of cold temperature.)

Test 7: Weight (Strength) Test**

Using an idea from the Tape Committee, the group put twelve ounces of fishing weights in a paper cup, attached a piece of wrap to the handle on the cup, and thumbtacked the other end of the wrap to the leg of an upturned bench. They timed to see how many minutes passed before the wrap tore and dropped the weights. Lady Lee ranked in first place for this strength test.

Test 8: Moisture Retention

The group designed a test in which they planned to weigh pieces of fruit or vegetables, wrap them in different brands of plastic wrap, let them stand for several days, and then unwrap them and weigh them again to see which brand of wrap best retained moisture. However, after performing their experiment, they lost their data before any comparison could be made.

*The students might also try this test with water.--ED.

**The children could compare the results of the retention of moisture and odor tests with tests on strength and stretchability to check any correlation. Does the wrap that stretches the least also retain the least moisture? --ED.

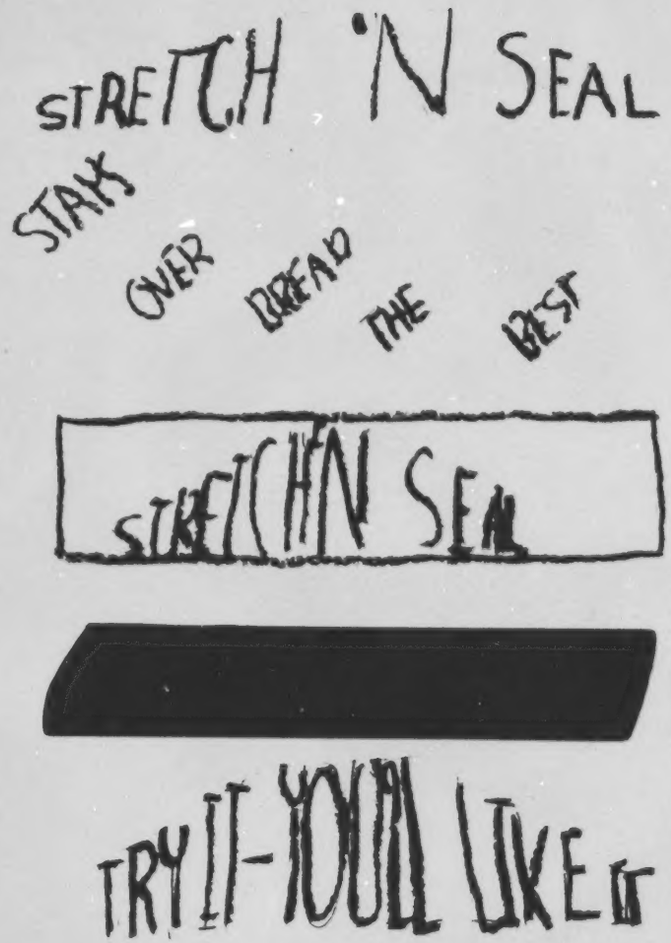

Figure C2-13

Conclusions:

When all the tests were completed, the group tallied the scores for each brand of plastic wrap. They were surprised to find that there was a three-way tie for third place.

First:	Stretch 'N Seal	(17 points)
Second:	Saran Wrap	(22 points)
Third:	Lady Lee	(24 points)
	Handi-Wrap	(24 points)
	Glad Wrap	(24 points)

However, the children did feel that there was enough separation of points between first and second places to unanimously recommend Stretch 'N Seal.* One student also devised an advertisement for this brand, as shown in Figure C2-13.

* * * * *

The remaining groups performed their tests with varying but lesser degrees of success. The Soap and Cleanser Group conducted only a few subjective tests although they worked diligently. The Seed and Fertilizer Group had their experiments destroyed by vandals, and they decided to test peanut butter. The Peanut Butter Group conducted subjective tests on taste, stickiness, spreadability, aroma, and reaction to heat with reasonable success. Although they performed six tests, the Ball-point Pen Group used the results only from two writing tests--on a wall and on masking tape. The Glue Group was partially successful in testing six brands for drying time, dry strength, strength under water, effect on paint, and absorption. While they lost the results of some of the tests, they did make a comparison using a point system. The Tape Group became disorganized and lost its records and notes.

* * * * *

*The children might also consider the cost per square foot of each of the wraps. If the better wrap costs significantly more, then a lower-rated brand may be a better choice.--ED.

CONSUMER
RESEARCH
4TH GRADE RM. 12 SPRING, 1972 MONTE VISTA SCHOOL
RESULTS of TESTING Plastic wrap, Aluminum foil
Glue, batteries, ballpoint pens, sponges, tape, cleansers

Figure C2-14

When we first began work on the Consumer Research challenge, the class discussed at great length the uses and value of our findings. At that time, the children said that the most valuable thing they could do would be to make recommendations for family purchasing. Later in the spring, one student mentioned that his family subscribed to *Consumer Reports* magazine, and he suggested that our class organize and produce a similar magazine outlining the results of our research and testing. This idea was avidly accepted by the class; the children immediately set about choosing an editor and an assistant editor who were then to select two art editors, a circulation manager, a managing editor, and reporters to write about tests already completed. The class decided that each committee would write a summary article about its activities when their tests were completed.

Unfortunately, we ran into difficulties toward the end of the school year. Although some work had begun on our magazine (Figure C2-14), most of the articles either were never started or were not completed in time to print. During the last few weeks of school when I felt that we needed to wind things up properly, the students were distracted by other school activities and often did not complete the things they had begun.

We did, however, share our results through the school newspaper. Different committees wrote weekly articles about our testing, and the last copy that appeared in June contained final results of the testing completed by all eight committees.

As well as positive approaches, I learned a good many things about how to conduct the unit next time. I would not try to have the children test eight products simultaneously but rather "feature" one at a time. Our greatest problem was being unfocused and disorganized. Committees would often compete for time and some were eclipsed.

My students did, however, respond with enthusiasm to our work on Consumer Research. Their interest needed occasional boosting, but, for the most part, they seemed genuinely interested in their activities and conclusions. It was gratifying to see my students grow throughout the year in their abilities to analyze, observe, experiment, create, tabulate, chart, approach things practically, and evaluate their own work.

3. LOG ON CONSUMER RESEARCH

by Richard Patterson*
Adams Community School, Grades 5-6
Washington, D.C.
(December 1971-June 1972)

ABSTRACT

A Consumer Research challenge arose in this combination class of fifth and sixth graders during a discussion about consumers. Preliminary product testing on transparent tape, paper towels, and food wraps made the students aware of the importance of consistent procedures in conducting valid tests. They retested paper towels and food wraps, treating the products in each test exactly the same. The students concluded that inexpensive brands often perform as well as more expensive brands. Further interest in product testing arose when these students, who sold school supplies to the entire school, were challenged by another class to prove that their pencils were of a better quality than another brand sold at a local drugstore. Both pencil brands were subjected to three tests: sharpening, erasing, and lead endurance. The tests were repeated several times, and in all three categories, the Arlington brand sold by the class was better. The students composed and sent a letter detailing their test procedures and results to the manager of the drugstore selling the inferior brand. They also prepared a report for the school and set up a consumer testing and reporting organization to test other frequently used products and to report to students and their parents on their findings.

The Consumer Research challenge arose in my class of fifth and sixth graders during a discussion about consumers. We examined types of consumers, including both adults and children, and discussed the qualities a consumer looks for when purchasing a product. As our discussion continued, one student commented that advertising claims made about products are not always truthful. When I asked what we, as consumers, could do to find out whether or not manufacturers gave accurate product descriptions, several students suggested product testing. The class then listed two reasons for testing products: (1) to discover the best brand of a product and (2) to find out whether manufacturers' claims were true.

*Edited by USMES staff

Since we had three brands of transparent tape on hand, I asked the students how they could test the tapes. They suggested testing the following properties:

1. Strength: How much weight will it support?
2. Stickiness: How well does it stick under different conditions? How long will it hold under water?...on hot surfaces?...on cold surfaces?
3. Surface damage: Does it take off paint or pull up plaster?
4. Ease of usage: Is it easy to use?

The class then devised and set up two impromptu tests. One test was for surface damage. The students placed a three-inch piece of each tape brand on the painted surface of a bulletin board. The next day they slowly pulled up each tape strip and looked for any evidence of damage to the painted surface. We recorded whether each tape brand came off easily, whether it peeled off paint, and how long it had been on the wall. In the second test, two bottles of tempera paint were suspended from the chalkboard by two different brands of tape. After twenty-four hours, one of these bottles was still hanging.

As we were setting up these two tests, we discussed the importance of validity in testing. How do we make a test valid? Why is it necessary to make a test valid? Are test results of any value afterwards? The class decided that without valid tests, other people would not believe the results. The students discussed how they had tried to make their tape tests fair by standardizing their procedures, for example measuring equal lengths of tape and weighing the bottles of paint to make sure they were equal.

After we had analyzed the results of our tape tests, the class divided into two groups, one to test paper towels and the other to test plastic wraps. The children themselves decided on the kinds of tests to perform and the procedures to follow.

Children testing paper towels worked individually or in small groups to test three brands, Scott, Bounty, and Truly Fine. The most frequent test performed was for absorbency. One group of students first measured an equal amount of water, one-half inch, into each of three cups. Into each cup they placed a different paper towel brand and waited for three seconds. The cups were then inverted to see whether any water remained unabsorbed. The results showed

Henry, Kieth, Frank

Test: Bounty and Scot

Time: 1:55

Materials: Bounty water cups
Scot water cups

What we did: We put water in to cups to see How well it soaks up. And Bounty Did not drip at all but Scot drip a Little

Results: Bounty is the best brand towels.

Reccommendation: I would recommed the Bounty becaus its soocks up water be than the other brand.

Figure C3-1

that Bounty ranked in first place as most absorbent (no water spilled out), Scott was second (some water spilled out), and Truly Fine was third or least absorbent (more water spilled). (See one group's results on two towels in Figure C3-1.) Some students also tested for strength by wetting the towels and then either pulling on them by hand or stretching them flat and putting objects on top of the wet spot.

The other group of students tested three food wraps, Saran Wrap, Handi-Wrap, and Stretch 'N Seal, for holding ability and strength. They filled cups with equal inches of water and then covered each one with a different brand of wrap. The students next turned the cups upside down to see whether the wraps would seal in the water. All of the brands were able to hold water for a short period of time, but later all of them began to leak. The students found, however, that Stretch 'N Seal held the water for the longest period of time.

While discussing their test procedures, the students realized the importance of consistent measuring to obtain accurate results. In some cases, equal amounts of water had not been measured, the time had been forgotten, or the size of the paper towels or the pieces of food wrap had not been measured. The students began to recognize the importance of these factors if they were to say that their tests were valid or, in fact, honest representations of the worth of the product.

In the next session the students repeated their tests on towels and food wraps, and this time they were careful to use consistent measurements for each product brand. Bounty still proved to be the best towel for absorbency, but Handi-Wrap tied with Stretch 'N Seal for holding ability and strength.

During the testing, I called the students' attention to the information contained on the product packages: claims of the manufacturer, price, and any specific instructions for using the product. The class compared the prices of the different brands according to the usual need and use for the product. They agreed that, in most cases, a less expensive brand can do as good a job as the more costly product, and sometimes it can do even better.*

*Before testing, the students might consider the cost per job (cost of piece used). If the required size piece of one brand costs twice as much as an equal piece of another brand, it could be expected to perform twice as well.--ED.

Jonnie Barksdale
Unit I
Feb. 14, 1972

Consumer Research
Name of test - Sharpening Test
Date 2-14-72
Products: Top Scholar and Arlington

Materials - Two different penals and the pencil sharpener

What we did I took an Arlington pencil and an Top Scholar and sharpened them 152 times each and the Arlington was tallest after 152 sharpens. At the begining it was 7 inches. And at the end the Arlington was 7 inches and the Top Scholar was 6 inches.

Recommendations: ~~Results~~ The Arlington because after 152 sharpens it is still the best and I think Arlington is worth the money.

Results - The Arlington is still the tallest of them. Top Scholar is not so good.

Figure C3-2

We then reviewed the purpose of testing products and discussed what we could do with our test results. Among the students' suggestions were the following:

"Buy only the best according to the test results."

"Ask store owners to stop selling other brands."

"Write to the maker."

"Tell our folks and neighbors not to use inferior brands."

Most students felt that product testing would help them to become better consumers and not to be cheated when they purchased products. When I asked how our test results compared with what the children had known about the products, the subject of advertising again came up. Some felt that TV claims had been accurate for some brands but very misleading for others. There was agreement with one student who said, "I think kids should make commercials and then we could tell the truth about a product."

Three class sessions were spent discussing advertisements and preparing our own product commercials. We talked about why manufacturers advertise and then examined various advertisements cut out of magazines. We looked at what different ads were saying to consumers, and I asked the students to list the adjectives used to make the products attractive (e.g., good, sweet, less expensive, fantastic, refreshing). This led into a discussion about the difference between "fact" and "opinion." Later the students wrote and videotaped commercials about a product we had tested, keeping in mind whether they were expressing fact or opinion. But our work on advertisements was temporarily interrupted when another class presented us with a practical consumer problem.

Our class was currently in the business of selling "Arlington" pencils and other school supplies to the students at Adams School. Another class had recently purchased "Top Scholar" pencils from a neighborhood drugstore, but these students found that the pencils were chewed up by the sharpener, the points broke easily, and the erasers would not erase well. The class challenged us to prove that our Arlington pencils were a better brand than Top Scholar.

My students met to discuss how we would answer the challenge proposed by the other class. They suggested three different tests--sharpening, erasing, and lead endurance--

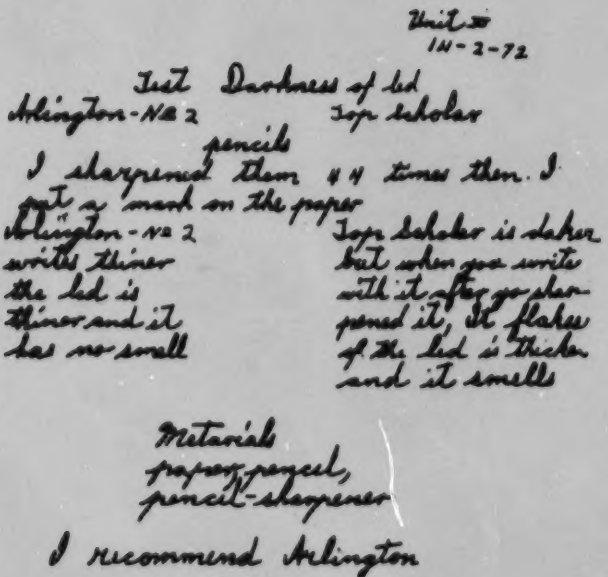

Figure C3-3

and we talked about the procedures to be followed in each. The class agreed that the same tests should be performed on both pencils so that a comparison could be made and that the test should be valid. We also decided that each group or each student who performed a test should write a brief report using the same data form. Included in the report would be the name of the test, date, materials used for testing, procedure followed, test results, and recommendation.

Students then worked individually or in small groups to carry out the tests, which are described below. Different groups or individuals used slightly different methods to test the same property.

* * * * * * * * * *

Sharpening Test

Students measured the length of each pencil before sharpening; both measured 7½ inches. Each pencil was then sharpened in the classroom sharpener with 100 turns of the handle. Both pencils were measured again. The Top Scholar measured 3½ inches in length whereas the Arlington pencil measured 4½ inches! The results were really exciting for the students who, of course, recommended using the Arlington pencil.

Other groups sharpened both pencils with more or fewer turns of the sharpener. One group used a different approach, sharpening each pencil with the fewest number of turns required to bring the writing end to a sharp point and then measuring the lengths of the pencils.* (See Figure C3-2.)

One student used the sharpening test to compare the darkness of the two pencil leads. After sharpening both brands for forty-four turns, he wrote with each pencil. He found that the Top Scholar lead was darker, but it flaked off and had a smell. Although the Arlington lead made lighter marks, it kept a sharper point and had no smell. He also recommended buying the Arlington pencil. (See Figure C3-3.)

Eraser Test

The students made two columns on a piece of paper and labeled them Arlington and Top Scholar. In each column,

*This group used the most valid approach. A pencil might be made of soft wood and require fewer turns of the sharpener in order to bring the lead to a point.--ED.

they placed a mark with a lead pencil, a red pencil, a ball-point pen, and a black felt-tip marker. The students then tried to erase each mark in fifty strokes using either the Arlington or the Top Scholar pencil.

The Top Scholar did not erase the ink or felt-tip marker; it smeared both the red pencil and the lead pencil marks, discoloring the paper and making holes in it. The Arlington pencil erased all marks well except for the felt-tip marker which it could not erase. A comparison of the erasers showed that the Top Scholar had worn down and broken off. Once again the recommendation was for the Arlington pencil.

Lead Endurance

Using the Top Scholar pencil, a student scribbled on a clean sheet of paper in a constant and regular manner until the lead tip wore down as far as the wood. He then repeated the same procedure using the Arlington pencil. Another student used a stopwatch to record the time from the start of the scribbling to the time the lead wore down. They found that the Top Scholar lead wore down in one minute, twenty seconds; the Arlington lead wore down in twenty-two minutes, seventeen seconds. The number of scribbles made with each pencil was not counted.

Other students who performed this test had slightly varying lengths of time, but they all discovered that the lead endurance of Arlington was overwhelmingly longer. The students again recommended Arlington as the better pencil.

* * * * * * * * *

After all the testing was completed, the students compared the results and decided that we had sufficient evidence to prove that the Arlington pencil was superior in quality to the Top Scholar. Besides informing the other class about the test results, the children wanted to carry out other activities related to our testing:

1. Form a consumer testing and reporting organization.
2. Draft a letter to the drugstore about our pencil tests.
3. Make a report for the school.
4. Prepare Arlington pencil commercials for videotaping.

Adams School
19th & Oaky Sts. NW.
Washington, D.C.

Manager
Drug Fair

Wash., D.C.

Dear Sir(s),

I am writing this letter in reference to a badly made item on your inventory.

I am a member of the "Adams Testers," an elementary consumer research group, and we have run some highly effective tests on the item in question.

The item is the "Top Scholar no. 2" pencil.

Our group found this pencil practically impossible to work with. The ~~test~~ results are below.

[*Test procedures and results were included at this point in the original letter.--ED.*]

So, after the results of these tests, we decided to inform you and urge you to take this product off your stock.

Sincerely,
Kinney Hulsey
WRITING CONSULTANT

Samuel Lynch
ASSOCIATE
Roger Withers
ASSOCIATE

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Figure C3-4

We discussed the effects of writing letters and agreed that the manufacturer would be concerned about our criticisms of the Top Scholar pencil and might consider altering or halting production. I suggested that when we informed either the manufacturer or the school of our results and recommendations, we should include a description of the tests we made on the various pencils.

The children formed committees to carry out the activities. Three students volunteered for the consumer testing and reporting organization, which was dubbed "The Adams Testers." Several children offered to write letters to the drugstore, and I suggested that they also keep an eye on future sales of Top Scholar pencils there. Other students volunteered to write the consumer research report for the school, and a committee for commercials and for advertisements was also organized.

By the next USMES session the students had drafted several letters and reports. Those writing to the drugstore had explained the deficiencies of the Top Scholar pencil and had described how it compared with the Arlington pencil in the tests performed (Figure C3-4). For the school report, other students had compiled a detailed description of the tests performed and the results obtained. (Figure C3-5.) I asked one student to write a concluding, overall report of the research completed. A boy from the Commercials and Advertisements Committee had devised several ads for the Arlington pencil in which he mentioned a few facts about the pencil and stressed why students should buy Arlington pencils. I told the children that I was trying to arrange for the filming of their commercials, and I suggested that, in the meantime, they could tape-record their ads to find out what it was like to make actual commercials.

A real feeling for the importance of testing emerged from the tests performed on the pencils. The students suggested forming a permanent consumer product-testing and reporting organization to test products brought to them by others or products that the members found particularly defective. They would then seek ways to bring about a change in the product or ways to make the consumer more knowledgeable about the value of the product.

The Adams Tester Report

Did you know that some boys and girls in room 207 have been learning to be good consumers? How?

They have been testing products to see if one is better than the other. They have been learning to look for the best product for the price, the best product for the use and studying commercials and advertisements in magazines and on T.V.

Recently the Adams Testers got some pencils from Mrs. Wingo's class. They told the Adams Testers that their pencils were lousy.

The Adams Testers decided to test these pencils.

Endurance Test

Kinney took an Top Scholar and marked on a piece of paper until the point wore down. This happened in 67 seconds. He took an Arlington pencil and did the same thing. But it took 21 mins. 19 seconds.

We recommend the Arlington pencil for a lot of writing or drawing. Top Scholar is okay good for short periods of writing. But I don't think it would be good for drawing.

Sharpening test - The following method was adopted to test the hardness of each pencil. First both the pencils Arlington and Top Scholar were measured 7½ inches in length. Then they were sharpened 50 times each. After 50 turns the following results were obtained.

Length

(1) Top Scholar - 1¾ inches after 50 turns
(2) Arlington - 5½ inches after 50 turns.

Since both the pencils are of the same hardness (#2). This test concludes that Top Scholar is inferior in quality to the Arlington.

Figure C3-5

4. MINI-LOG ON CONSUMER RESEARCH
Comparing Prices

by Sandra Stevens*
Vista View School, Grade 4
Burnsville, Minnesota
(November 1973-February 1974)

ABSTRACT

*This group of eight special students who were not responding well to the textbook-oriented school program, worked two to three hours a week on the Consumer Research challenge for ten weeks. They investigated different characteristics of dry cereals, including price, staleness, and sogginess. The students compared prices of three different cereals (Wheaties, Grape-Nuts, and Frosted Flakes) at three nearby supermarkets and found which store had the lowest prices per unit weight for these items. The children drew slope diagrams** to help with their price comparisons. Although not covered in this mini-log, the class also tested the cereals for staleness and sogginess and reported on their findings to other classes and to parents.*

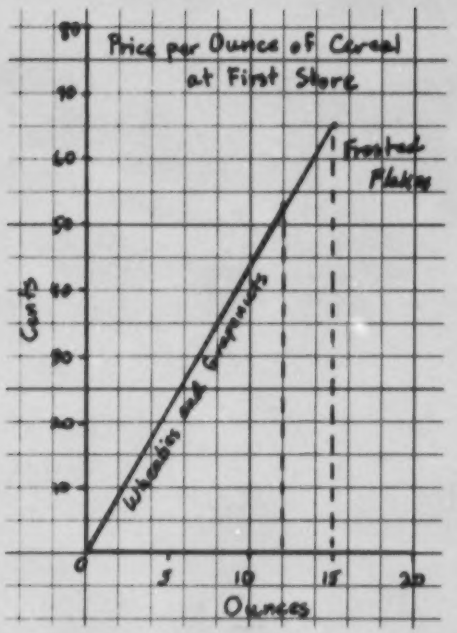


Figure C4-1

We began our first meeting by discussing the term consumer: Who are consumers? How do consumers decide what to buy? How should consumers decide on a product? The students described items that they or their parents often purchased and their reasons for buying certain products. This led to a discussion of why a consumer should do some research before making purchases, and the students listed the following reasons:

1. to discover the best brands
2. to test the manufacturer's claims
3. to get the best buy for your money

During the next class we reviewed our discussion about consumers and we decided that one way to do research on a product would be to test several brands. After discussing various problems with items purchased, everyone agreed that soggy cereal was a common problem they would like to investigate. The students had a very difficult time trying to limit the number of cereals they would test. After much discussion, they finally agreed on three cereals, Frosted Flakes, Wheaties, and Grape-Nuts, with one boy holding out

*Edited by USMES Staff
**Formerly called triangle diagram.

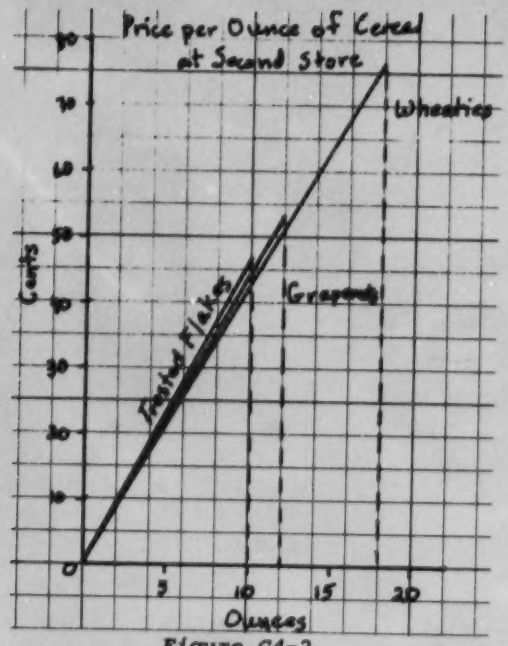


Figure C4-2

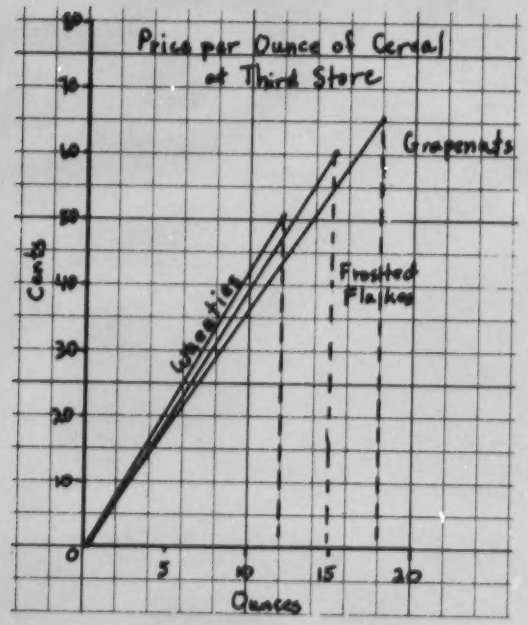


Figure C4-3

for Heartland Natural Cereal. With the brands chosen, the students listed several factors that they would be interested in testing or comparing:

1. sogginess
2. price
3. nutritional value
4. sugar content
5. staleness
6. prizes or offers on the back of packages

We decided to visit three stores located near the school to compare cereal prices and availability. We first went shopping at a small market just two blocks from school and recorded the following information:

1. Wheaties in a 12-ounce box for 53¢
2. Grape-Nuts in a 12-ounce box for 53¢
3. Frosted Flakes in a 15-ounce box for 65¢ (only one size available)

During our visit two students became involved in a lively discussion concerning the box sizes for Wheaties and Grape-Nuts. Both boxes contained twelve ounces, yet the Wheaties box was much larger. They finally decided to compare the contents when we actually purchased the cereals.

When we returned to class, I introduced the children to the slope diagram as an easy way to determine relative cost without dividing price by number of ounces. We worked together as a group and transferred the data gathered from the first store to a slope diagram similar to that shown in Figure C4-1. We then compared the slopes of the lines and determined that Frosted Flakes cost less per ounce than the other cereals.

On our visit to a second market we found the following prices and box sizes:

1. Frosted Flakes in a 10-ounce box for 47¢
2. Grape-Nuts in a 12-ounce box for 53¢
3. Wheaties in an 18-ounce box for 77¢

We again used a slope diagram to determine that at this store Frosted Flakes cost the most per ounce and Wheaties cost the least. (See Figure C4-2.)

The next day we visited a third store and recorded more information about the three cereals:

ATTENTION SOGGY CEREAL EATERS

Tired of starting each day with soggy cereal? Then this is for you!

Our USMES group has been studying various cereals in our Consumer Research Unit. Here is what we found:

1. Sullivans Super Value is cheaper than Brooks and Kenny's Supermarkets.
2. Sullivans has more cereals to choose from and a large variety of sizes.
3. Frosted Flakes soaked up the least amount of milk while Wheaties soaked up the next least amount of milk. Grape Nuts soaked up every last drop!

If you have any questions about our research, please feel free to ask us.

David	Jamie
John	Debbie
Sheri	Deanna
Dean	Chrissy

Figure C4-4

1. Wheaties in a 12-ounce box for 51¢
2. Frosted Flakes in a 15-ounce box for 61¢
3. Grape-Nuts in an 18-ounce box for 66¢

When we transferred this data to a slope diagram (see Figure C4-3), we found that Grape-Nuts cost less per ounce than Frosted Flakes or Wheaties.*

Using the data from the three stores, I tried to help the children divide ounces into cost to find the exact cost per ounce. However, I soon discovered that the students had a limited knowledge of division and the use of decimals. We returned to the slope diagrams and the students were then able to compare prices. They concluded that the third store had the best buys for all three cereals,** and they decided to make their purchases there.

When the class had completed its research on cereals, we spent two days writing letters to the students' parents telling them about our work on the Consumer Research challenge. The information included prices at different stores and the availability of different cereals. Their information sheet is shown in Figure C4-4.

The students later reported their test findings to their homerooms. These presentations ended with question-and-answer periods involving the entire class with the USMES students.

*The children might discuss how the size of the package affects the price. They could draw a slope diagram for each cereal to compare the cost per ounce for the different-sized packages.

**The comparison among stores can be done by placing one graph over another. The graph which has lines with the least slope will show the best buys, provided the scales on the graphs are identical.

D. References

1. LIST OF "HOW TO" CARDS

Below are listed the current "How To" Card titles that students working on the Consumer Research challenge might find useful. A complete listing of both the "How To" Cards and the Design Lab "How To" Cards is contained in the USMES Guide. In addition, the Design Lab Manual contains the list of Design Lab "How To" Cards.

GRAPHING

GR 1 How to Make a Bar Graph Picture of Your Data
GR 2 How to Show the Differences in Many Measurements or Counts of the Same Thing by Making a Histogram
GR 3 How to Make a Line Graph Picture of Your Data
GR 4 How to Decide Whether to Make a Bar Graph Picture or a Line Graph Picture of Your Data
GR 5 How to Find Out If There is Any Relationship Between Two Things by Making a Scatter Graph
GR 6 How to Make Predictions by Using a Scatter Graph
GR 7 How to Show Several Sets of Data on One Graph

MEASUREMENT

M 1 How to Use a Stopwatch
M 9 How to Make a Conversion Graph to Use in Changing Measurements from One Unit to Another Unit
M 10 How to Use a Conversion Graph to Change *Any* Measurement in One Unit to Another Unit

PROBABILITY AND STATISTICS

PS 2 How to Record Data by Tallying
PS 3 How to Describe Your Set of Data by Finding the Average
PS 4 How to Describe Your Set of Data by Using the Middle Piece (Median)
PS 5 How to Find the Median of a Set of Data from a Histogram

RATIOS, PROPORTIONS, AND SCALING

R 1 How to Compare Fractions or Ratios by Making a Triangle Diagram*
R 2 How to Make a Drawing to Scale
R 3 How to Make Scale Drawings Bigger or Smaller

*Presently called Slope Diagram.

New titles to be added in 1976:

How to Round Off Data
How to Compare Two Sets of Data by Making a Q-Q Graph
How to Design and Analyze a Survey
How to Choose a Sample
How to Compare Two Sets of Data by Using Interquartile Ranges
How to Design an Experiment
How to Make and Use a Cumulative Distribution Graph

A cartoon-style set of "How To" Cards for primary grades is being developed from the present complete set. In most cases titles are different and contents have been rearranged among the various titles. It is planned that this additional set will be available early in 1977.

2. LIST OF BACKGROUND PAPERS

As students work on USMES challenges, teachers may need background information that is not readily accessible elsewhere. The Background Papers fulfill this need and often include descriptions of activities and investigations that students might carry out.

Below are listed titles of current Background Papers that teachers may find pertinent to Consumer Research. The papers are grouped in the categories shown, but in some cases the categories overlap. For example, some papers about graphing also deal with probability and statistics.

The Background Papers are being revised, reorganized, and rewritten. As a result, many of the titles will change.

GRAPHING

GR 3 Using Graphs to Understand Data by Earle Lomon
GR 4 Representing Several Sets of Data on One Graph by Betty Beck
GR 6 Using Scatter Graphs to Spot Trends by Earle Lomon
GR 7 Data Gathering and Generating Graphs at the Same Time (or Stack 'Em and Graph 'Em at One Fell Swoop!) by Edward Liddle

GROUP DYNAMICS

GD 2 A Voting Procedure Comparison That May Arise in USMES Activities by Earle Lomon

MEASUREMENT

M 3 Determining the Best Instrument to Use for a Certain Measurement by USMES Staff

PROBABILITY AND STATISTICS

PS 4 Design of Surveys and Samples by Susan J. Devlin and Anne E. Freeny
PS 5 Examining One and Two Sets of Data Part I: A General Strategy and One-Sample Methods by Lorraine Denby and James Landwehr
PS 6 Examining One and Two Sets of Data Part II: A Graphical Method for Comparing Two Samples by Lorraine Denby and James Landwehr

RATIOS, PROPORTIONS, AND SCALING

R 1 Graphic Comparison of Fractions by Merrill Goldberg
R 2 Geometric Comparison of Ratios by Earle Lomon

3. BIBLIOGRAPHY OF NON-USMES MATERIALS

The following materials are references that may be of some use during work on Consumer Research. The teacher is advised to check directly with the publisher regarding current prices. A list of references on general mathematics and science topics can be found in the *USMES Guide*.

Consumer Education Materials Project. *Elementary Level Consumer Education*. Mount Vernon, N.Y.: Consumers Union of the U.S., Inc., 1972. ($3.00. Order from Consumers Union, Education Services Division, Orangeburg, N.Y. 10962.)

Case studies from various school districts and communities demonstrate various approaches to teaching consumer education. One example is from an USMES class in Washington, D.C.

Consumer Product Information Center. *Consumer Information Index*. Washington, D.C.: U.S. Government Printing Office. (Free. Order from Consumer Information, Public Documents Distribution Center, Pueblo, Colorado 81009.)

A quarterly listing of approximately 200 government publications related to consumerism, for example, "Banned Products List," "Consumer Education Bibliography," "Safe Toy Tips." Most pamphlets are inexpensive, and many are free.

Consumers Union. *Consumer Reports*. Orangeburg, N.Y.: Consumers Union of the U.S., Inc. (Yearly subscription, $12.00. School Order Plan: Special low school price for minimum monthly order of 20 copies; available by semester or by school year. Write to Consumer Reports, Education Dept., Orangeburg, N.Y. 10962.)

A nonprofit magazine that details procedures and results of product tests performed on a wide variety of consumer items. Intermediate students.

_____. *Teaching Tools for Consumer Reports*. (Free monthly copy included with School Order Plan. Also available by separate subscriptions. Order from above address.)

Lesson plans and teaching ideas for each monthly issue of *Consumer Reports*.

Buy and Buy. ($150.00 for 15-minute color film. Order from National Instructional Television, Box A, Bloomington, Indiana 47401.)

Discusses decision-making problems encountered in selecting and purchasing products. Recommended by several education journals. Intermediate level.

4. GLOSSARY

The following definitions may be helpful to a teacher whose class is investigating a Consumer Research challenge. These terms may be used when they are appropriate for the children's work. For example, a teacher may tell the children that when they conduct surveys, they are collecting *data*. It is not necessary for the teacher or students to learn the definitions nor to use all of these terms while working on their challenge. Rather, the children will begin to use the words and understand the meanings as they become involved in their investigations.

Average	The numerical value obtained by dividing the sum of the elements of a set of data by the number of elements in that set. Also called the mean.
Comparative Shopping	A method for determining the best buy(s) by comparing the costs, quantities, and qualities of different brands of products.
Consumer	A person who buys or uses goods or services.
Conversion	A change from one form to another. Generally associated in mathematics and science with the change from one unit of measure to another or the change from one form of energy to another.
Correlation	A relationship between two sets of data.
Cost	The amount of money needed to produce or to purchase goods or services.
Data	Any facts, quantitative information, or statistics.
Discount	A reduction in the price of products or services, often stated as a percentage of price. This is done (1) for customers who buy in large quantities or (2) in order to generate a greater volume of sales.
Distribution	The spread of data over the range of possible results.
Economics	A social science concerned chiefly with description and analysis of the production, distribution, and consumption of goods and services.

Frequency

The number of times a certain event occurs in a given unit of time or in a given total number of events.

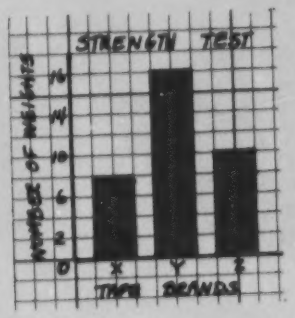
Graph

A drawing or a picture of one or several sets of data.

Bar Graph

A graph of a set of measures or counts whose sizes are represented by the vertical (or horizontal) lengths of bars of equal widths. Example: the number of one-ounce weights different tape brands can hold before breaking.

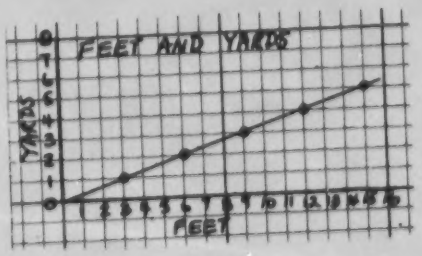
BRAND	NO. OF 1-OZ. WEIGHTS
X	8
Y	16
Z	10



Conversion Graph

A line graph that is used to change one unit of measurement to another. For example, changing feet to yards or vice versa.

YARDS	FEET
1	3
2	6
3	9
4	12
5	15

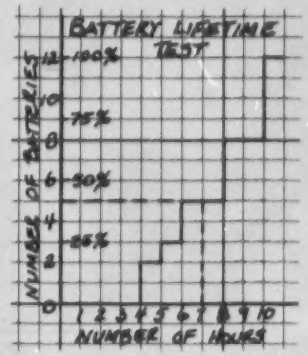


Cumulative Distribution Graph

A graph that can be constructed from a histogram by computing running totals from the histogram data. The first running total is the first value in the histogram data (see table of values). The second running total is the sum of the first and second values of the histogram, the third is the sum of the first, second, and third values, and so on. The horizontal scale on the graph is similar to that of the histogram; the vertical scale goes from 0 to the total number of events observed or samples taken (in the example, total numbers of batteries tested). Each vertical distance on the graph shows the running total of the number of samples taken that are less than or equal to the value shown on the horizontal scale; thus the graph below indicates that five, or approximately 42%, of the batteries lasted seven hours or less.

TABLE OF VALUES

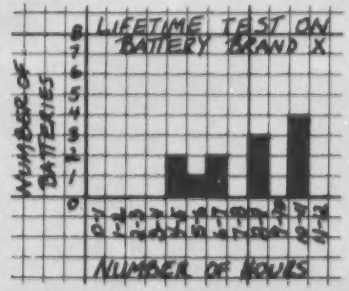
NO. OF HOURS	RUNNING TOTALS
5 or less	2
6 or less	3
7 or less	5
8 or less	5
9 or less	8
10 or less	8
11 or less	12



Histogram

A type of bar graph that shows the distribution of the number of times that different measures or counts of the same event have occurred. A histogram always shows ordered numerical data on the horizontal axis. Example: the numbers of batteries of one brand that have a certain lifetime.

LIFETIME (IN HOURS)	NO. OF BATTERIES
4-5	2
5-6	1
6-7	2
7-8	0
8-9	3
9-10	0
10-11	4

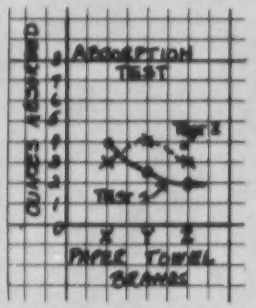


Line Chart

A bar graph that is represented by circles, crosses, or triangles with lines connecting them so that it has the appearance of a line graph. (See *Line Graph*.) This is a useful representation when two or more sets of data are shown on the same graph. Example: the average amounts of water absorbed by different paper towel brands in repeated tests.

OUNCES OF WATER ABSORBED

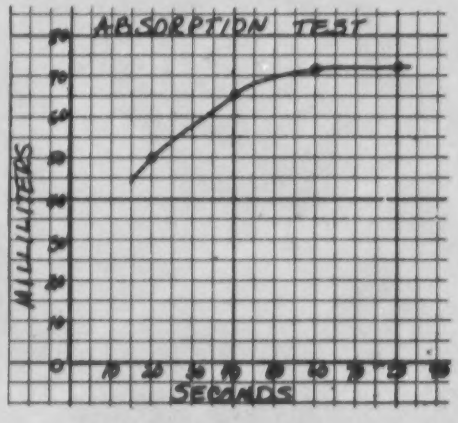
BRAND	TEST #1	TEST #2
X	4	3
Y	2¾	4
Z	2	3



Line Graph

A graph in which a smooth line or line segments pass through or near points representing members of a set of data. Since the line represents an infinity of points, the variable on the horizontal axis must be continuous. If the spaces between the markings on the horizontal axis have no meaning, then the graph is not a line graph, but a line chart (see *Line Chart)*, even if the data points are connected by lines. Example: amount of water absorbed by one brand of paper towel. (This is a line graph since the approximate amount of water absorbed after thirty seconds can be found by looking at the graph, even though the water was not actually measured after thirty seconds.)

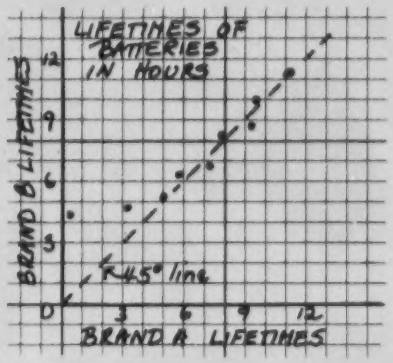
NO. OF SECONDS	MILLILITERS ABSORBED
20	50
40	65
60	72
80	72



Q-Q Graph

A graph that shows the comparison between the same type of data collected from two comparable samples, e.g., from two brands of a product. The data for each set is ordered and the smallest measurement of one set plotted against the smallest of the other set, the second smallest against the second smallest, and so on. The scatter of points is compared to a reference line, a dashed 45° line that represents data from two identical sets. Example: the lifetimes of two brands of batteries.

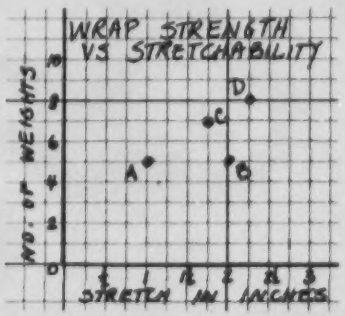
BATTERY LIFETIMES IN HOURS	
BRAND A	BRAND B
.5	4.2
3.1	4.6
5.0	5.1
5.9	6.3
7.2	6.8
7.8	8.1
9.3	8.9
9.5	10.0
11.3	11.1



Scatter Graph

A graph showing a scatter of points, each of which represents two characteristics of the same thing. For example, in the graph below, each point represents the number of one-ounce weights a plastic wrap will hold before breaking compared to the amount of stretch of that wrap.

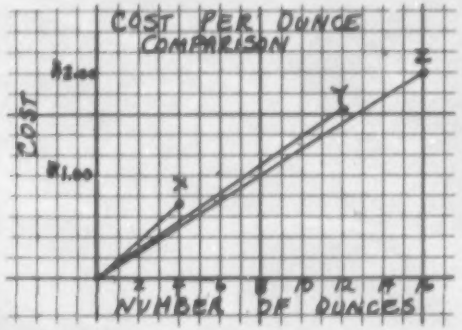
BRAND	NO. 1-OZ WEIGHTS	AMOUNT OF STRETCH
A	5	1"
B	5	2"
C	7	1¾"
D	8	2½"



*Slope Diagram**

A graphical means of comparing fractions or ratios. To represent the ratio a/b, plot the point (b,a) and draw a line from (b,a) to the origin, (0,0). The slope of this line represents the ratio a/b. By comparing slopes of several lines, different ratios can be compared; the less steep the line, the smaller the ratio. For example, the diagram shows the ratio of price to weight for different brands of glue. The ratio of price to weight for Brand Z is smaller than that for Brands X or Y, and therefore, Brand Z costs the least per ounce.

BRAND	PRICE	WEIGHT
X	$.75	4 oz.
Y	$1.62	12 oz.
Z	$2.00	16 oz.



Histogram

See *Graph*.

Hypothesis

A tentative conclusion made in order to test its implications or consequences.

Inference

An assumption derived from facts or information considered to be valid and accurate.

Interest

A charge for borrowing money; generally a percentage of the amount borrowed.

Marketing

The study or implementation of the most profitable and efficient methods of directing goods from manufacturer to consumer.

Market Research

The compilation of statistical information concerning consumers or purchasers.

Mean

See *Average*.

*Formerly called Triangle Diagram.

Median	The middle value of a set of data in which the elements have been ordered from smallest to largest. The median value has as many elements above it as below it.
Mode	The element or elements in a set of data that occur most often.
Ordered Set	A set of data arranged from smallest to largest.
Per Cent	Literally per hundred. A ratio in which the denominator is always 100, e.g., 72 percent = 72/100 = 0.72 = 72% , where the symbol % represents 1/100.
Percentage	A part of a whole expressed in hundredths.
Population	Any group of objects (e.g., people, items) or events from which samples are taken for statistical measurement.
Probability	The likelihood or chance (expressed numerically) of one event occurring out of several possible events.
Profit	The excess of monetary returns over expenditures; the excess of the selling price of goods over their cost. (Often called net income.)
Proportion	A statement of equality of two ratios, i.e., the first term divided by the second term equals the third term divided by the fourth term, e.g., 5/10 = 1/2. Also a synonym for ratio: when two quantities are in direct proportion, their ratios are the same.
Quartile	
First	The first quartile is the value of the quarter-way piece of data in an ordered set of data.
Third	The third quartile is the value of the three-quarter-way piece of data in an ordered set of data.
Interquartile Range	The range or length of the middle 50% of an ordered set of data; the difference between the first and third quartile.
Range	Mathematical: the difference between the smallest and the largest values in a set of data.
Rank	To order the members of a set according to some criterion, such as size or importance. Example: to put pieces of data from smallest to largest.

Ratio	The quotient of two denominate numbers or values indicating the relationship in quantity, size, or amount between two different things. For example, the ratio of the number of red pieces of candy compared to the total pieces of candy in a package might be $\frac{10}{25}$ or 10:25.
Retail Price	The price level of goods sold in small quantity to the consumer.
Sample	A representative fraction of a population studied to gain information about the whole population.
Sample Size	The number of elements in a sample.
Scale	A direct proportion between two sets of dimensions (as between the dimensions in a drawing of a classroom and the actual room).
Scale Drawing	A drawing whose dimensions are in direct proportion to the object drawn.
Scale Model	A three-dimensional representation constructed to scale.
Set	A collection of characteristics, persons, or objects. Each thing in a set is called a member or an element.
Statistics	The science of drawing conclusions or making predictions using a collection of quantitative data.
Tally	A visible record used to keep a count of some set of data, especially a record of the number of times one or more events occur. Example: the number of weights dropped onto plastic wrap before it breaks.
Wholesale Price	The price level of goods sold in large quantity to a merchant for resale.

E. Skills, Processes, and Areas of Study Utilized in Consumer Research

The unique aspect of USMES is the degree to which it provides experience in the process of solving real problems. Many would agree that this aspect of learning is so important as to deserve a regular place in the school program even if it means decreasing to some extent the time spent in other important areas. Fortunately, real problem solving is also an effective way of learning many of the skills, processes, and concepts in a wide range of school subjects.

On the following pages are five charts and an extensive, illustrative list of skills, processes, and areas of study that are utilized in USMES. The charts rate Consumer Research according to its potential for learning in various categories of each of five subject areas--real problem solving, mathematics, science, social science, and language arts. The rating system is based on the amount that each skill, process, or area of study within the subject areas is used--extensive (1), moderate (2), some (3), little or no use (-). (The USMES Guide contains a chart that rates all USMES units in a similar way.)

The chart for real problem solving presents the many aspects of the problem-solving process that students generally use while working on an USMES challenge. A number of the steps in the process are used many times and in different orders, and many of the steps can be performed concurrently by separate groups of students. Each aspect listed in the chart applies not only to the major problem stated in the unit challenge but also to many of the tasks each small group undertakes while working on a solution to the major problem. Consequently, USMES students gain extensive experience with the problem-solving process.

The charts for mathematics, science, social science, and language arts identify the specific skills, processes, and areas of study that may be learned by students as they respond to a Consumer Research challenge and become involved with certain activities. Because the students initiate the activities, it is impossible to state unequivocally which activities will take place. It is possible, however, to document activities that have taken place in USMES classes and identify those skills and processes that have been used by the students.

Knowing in advance which skills and processes are likely to be utilized in Consumer Research and knowing the extent that they will be used, teachers can postpone the teaching

of those skills in the traditional manner until later in the year. If the students have not learned them during their USMES activities by that time, they can study them in the usual way. Further, the charts enable a teacher to integrate USMES more readily with other areas of classroom work. For example, teachers may teach fractions during math period when fractions are also being learned and utilized in the students' USMES activities. Teachers who have used USMES for several successive years have found that students are more motivated to learn basic skills when they have determined a need for them in their USMES activities. During an USMES session the teacher may allow the students to learn the skills entirely on their own or from other students, or the teacher may conduct a skill session as the need for a particular skill arises.

Because different USMES units have differing emphases on the various aspects of problem solving and varying amounts of possible work in the various subject areas, teachers each year might select several possible challenges, based on their students' previous work in USMES, for their class to consider. This choice should provide students with as extensive a range of problems and as wide a variety of skills, processes, and areas of study as possible during their years in school. The charts and lists on the following pages can also help teachers with this type of planning.

Some USMES teachers have used a chart similar to the one given here for real problem solving as a record-keeping tool, noting each child's exposure to the various aspects of the process. Such a chart might be kept current by succeeding teachers and passed on as part of a student's permanent record. Each year some attempt could be made to vary a student's learning not only by introducing different types of challenges but also by altering the specific activities in which each student takes part. For example, children who have done mostly construction work in one unit may be encouraged to take part in the data collection and data analysis in their next unit.

Following the rating charts are the lists of explicit examples of real problem solving and other subject area skills, processes, and areas of study learned and utilized in Consumer Research. Like the charts, these lists are based on documentation of activities that have taken place in USMES classes. The greater detail of the lists allows teachers to see exactly how the various basic skills, processes, and areas of study listed in the charts may arise in Consumer Research.

The number of examples in the real problem solving list have been limited because the list itself would be unreasonably long if all the examples were listed for some of the categories. It should also be noted that the example(s) in the first category--*Identifying and Defining Problems*--have been limited to the major problem that is the focus of the unit. During the course of their work, the students will encounter and solve many other, secondary problems, such as the problem of how to display their data or how to draw a scale layout.

Breaking down an interdisciplinary curriculum like USMES into its various subject area components is a difficult and highly inexact procedure. Within USMES the various subject areas overlap significantly, and any subdivision must be to some extent arbitrary. For example, where does measuring as a mathematical skill end and measurement as science and social science process begin? How does one distinguish between the processes of real problem solving, of science, and of social science? Even within one subject area, the problem still remains--what is the difference between graphing as a skill and graphing as an area of study? This problem has been partially solved by judicious choice of examples and extensive cross-referencing.

Because of this overlap of subject areas, there are clearly other outlines that are equally valid. The scheme presented here was developed with much care and thought by members of the USMES staff with help from others knowledgeable in the fields of mathematics, science, social science, and language arts. It represents one method of examining comprehensively the scope of USMES and in no way denies the existence of other methods.

REAL PROBLEM SOLVING	Overall Rating
Identifying and defining problem	1
Deciding on information and investigations needed.	1
Determining what needs to be done first, setting priorities.	1
Deciding on best ways to obtain information needed.	1
Working cooperatively in groups on tasks.	1
Making decisions as needed.	1
Utilizing and appreciating basic skills and processes.	1
Carrying out data collection procedures--observing, surveying, researching, measuring, classifying, experimenting, constructing.	1
Asking questions, inferring.	1
Distinguishing fact from opinion, relevant from irrelevant data, reliable from unreliable sources.	1

REAL PROBLEM SOLVING	Overall Rating
Evaluating procedures used for data collection and analysis, Detecting flaws in process or errors in data.	1
Organizing and processing data or information.	1
Analyzing and interpreting data or information.	1
Predicting, formulating hypotheses, suggesting possible solutions based on data collected.	1
Evaluating proposed solutions in terms of practicality, social values, efficacy, aesthetic values.	1
Trying out various soltuions and evaluating the results, testing hypotheses.	1
Communicating and displaying data or information.	1
Working to implement solution(s) chosen by the class.	1
Making generalizations that might hold true under similar circumstances; applying problem-solving process to other real problems.	1

KEY: 1 = extensive use, 2 = moderate use, 3 = some use, - = little or no use.

MATHEMATICS	Overall Rating
Basic Skills	
Classifying/Categorizing	1
Counting	1
Computation Using Operations	
Addition/Subtraction	1
Multiplication/Division	1
Fractions/Ratios/Percentages	1
Business and Consumer Mathematics/ Money and Finance	1
Measuring	1
Comparing	1
Estimating/Approximating/Rounding Off	1
Organizing Data	1
Statistical Analysis	1
Opinion Surveys/Sampling Techniques	3
Graphing	1
Spatial Visualization/Geometry	-
Areas of Study	
Numeration Systems	1
Number Systems and Properties	1
Denominate Numbers/Dimensions	1
Scaling	-
Symmetry/Similarity/Congruence	-
Accuracy/Measurement Error/ Estimation/Approximation	1
Statistics/Random Processes/Probability	1
Graphing/Functions	1
Fraction/Ratio	1
Maximum and Minimum Values	3
Equivalence/Inequality/Equations	1
Money/Finance	1
Set Theory	2

SCIENCE	Overall Rating
Processes	
Observing/Describing	1
Classifying	1
Identifying Variables	1
Defining Variables Operationally	1
Manipulating, Controlling Variables/ Experimenting	1
Designing and Constructing Measuring Devices and Equipment	2
Inferring/Predicting/Formulating, Testing Hypotheses/Modeling	1
Measuring/Collecting, Recording Data	1
Organizing, Processing Data	1
Analyzing, Interpreting Data	1
Communicating, Displaying Data	1
Generalizing/Applying Process to New Problems	1
Areas of Study	
Measurement	2
Motion	-
Force	2
Mechanical Work and Energy	3
Solids, Liquids, and Gases	1
Electricity	-
Heat	3
Light	-
Sound	-
Animal and Plant Classification	-
Ecology/Environment	-
Nutrition/Growth	3
Genetics/Heredity/Propagation	-
Animal and Plant Behavior	-
Anatomy/Physiology	-

KEY: 1 = extensive use, 2 = moderate use, 3 = some use, - = little or no use

SOCIAL SCIENCE	Overall Rating
Process	
Observing/Describing/Classifying	1
Identifying Problems, Variables	1
Manipulating, Controlling Variables/ Experimenting	3
Inferring/Predicting/Formulating, Testing Hypotheses	2
Collecting, Recording Data/Measuring	2
Organizing, Processing Data	2
Analyzing, Interpreting Data	2
Communicating, Displaying Data	2
Generalizing/Applying Process to Daily Life	2
Attitudes/Values	
Accepting responsibility for actions and results	1
Developing interest and involvement in human affairs	1
Recognizing the importance of individual and group contributions to society	1
Developing inquisitiveness, self-reliance, and initiative	1
Recognizing the values of cooperation, group work, and division of labor	1
Understanding modes of inquiry used in the sciences, appreciating their power and precision	1
Respecting the views, thoughts, and feelings of others	1
Being open to new ideas and information	1
Learning the importance and influence of values in decision making	1
Areas of Study	
Anthropology	-
Economics	1
Geography/Physical Environment	-
Political Science/Government Systems	2
Recent Local History	-
Social Psychology/Individual and Group Behavior	3
Sociology/Social Systems	2

LANGUAGE ARTS	Overall Rating
Basic Skills	
Reading	
Literal Comprehension: Decoding Words Sentences, Paragraphs	2
Critical Reading: Comprehending Meanings, Interpretation	2
Oral Language	
Speaking	1
Listening	1
Memorizing	-
Written Language	
Spelling	2
Grammar: Punctuation, Syntax, Usage	2
Composition	2
Study Skills	
Outlining/Organizing	2
Using References and Resources	3
Attitudes/Values	
Appreciating the value of expressing ideas through speaking and writing	1
Appreciating the value of written resources	3
Developing an interest in reading and writing	2
Making judgments concerning what is read	2
Appreciating the value of different forms of writing, different forms of communication	1

KEY: 1 = extensive use, 2 = moderate use, 3 = some use, - = little or no use

REAL PROBLEM SOLVING IN CONSUMER RESEARCH

Identifying and Defining Problems	• Students decide to determine what brand of potato chips is the best for their party. • See also SOCIAL SCIENCE list: *Identifying Problems, Variables.*
Deciding on Information and Investigations Needed	• Students decide to find out about the cost of the various brands of potato chips, which brand people like best, and the ingredients and amount of greasiness in the various brands.
Determining What Needs to Be Done First, Setting Priorities	• Students decide to check on costs, ingredients, and amount of greasiness before conducting taste test.
Deciding on Best Ways to Obtain Information Needed	• Students decide to determine prices at stores of different types and to check amounts of greasiness by conducting an experiment.
Working Cooperatively in Groups on Tasks	• Students form groups to (1) check prices and ingredients, (2) design experiment for greasiness, and (3) design a survey to determine students' preferences.
Making Decisions as Needed	• Students decide to conduct a taste test rather than an opinion survey. • Students decide to pick a sample of students from three classes for the taste test. • Students decide that brand X is the best to buy in terms of cost and student preference.
Utilizing and Appreciating Basic Skills and Processes	• Students tally results of taste test and calculate preference rating for each brand. • Students calculate cost per ounce for each brand. • Students set up a controlled experiment for testing greasiness. • Students use equal arm balance to weigh equal amounts of potato chips. • Students recognize that people's tastes vary. • Students find that comparative pricing is worthwhile. • Students report to the class on their findings.

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Utilizing and Appreciating Basic Skills and Processes (cont.)	• Students present their findings to the school dietitian. • See also MATHEMATICS, SCIENCE, SOCIAL SCIENCE, and LANGUAGE ARTS lists.
Carrying Out Data Collection Procedures--Opinion Surveying, Researching, Measuring, Classifying, Experimenting, Constructing	• Students collect information on costs from three stores. • Students list ingredients in brands of potato chips. • Students weigh potato chips. • Students carry out and repeat taste test. • Students carry out and repeat test for greasiness. • Students classify brands in terms of cost, preference, and greasiness. • Students construct transparent grid to measure area of grease spot. • See also MATHEMATICS list: *Classifying/Categorizing; Measuring.* • See also SCIENCE list: *Observing/Describing; Classifying; Manipulating, Controlling Variables/Experimenting; Designing and Constructing Measuring Devices and Equipment; Measuring/Collecting, Recording Data.* • See also SOCIAL SCIENCE list: *Observing/Describing/Classifying; Manipulating, Controlling Variables/Experimenting; Collecting, Recording Data/Measuring.*
Asking Questions, Inferring	• Students ask whether the most expensive brand of potato chips is the best. • Students infer from their data that brand X is preferred by more students than brand Y. • Students infer that the best buy is the brand that has the best combination of cost and preference characteristics. • Students infer that people do not like greasy potato chips because the brand liked the best was the least greasy of the brands tested. • See also SCIENCE list: *Inferring/Predicting/Formulating, Testing Hypotheses/Modeling.* • See also SOCIAL SCIENCE list: *Inferring/Predicting/Formulating, Testing Hypotheses.*
Distinguishing Fact from Opinion, Relevant from Irrelevant Data, Reliable from Unreliable Sources	• Students recognize that data collected from actual taste tests is better than data collected on opinions with no tasting. • Students recognize that information collected on adult preferences is not relevant to choosing a brand to be served at a party for children.

Evaluating Procedures Used for Data Collection and Analysis, Detecting Flaws in Process or Errors in Data

- Students evaluate procedures for taste testing. They decide that the brands should be used in a random order each time and that each person should rinse his/her mouth out between tastes.
- Students find that repeated tests on the amount of greasiness do not yield similar results. They decide that the same type of paper should be used each time.
- See also MATHEMATICS list: *Estimating/Approximating/Rounding Off.*

Organizing and Processing Data

- Students record their data on charts.
- Students make graphs of their data.
- See also MATHEMATICS list: *Organizing Data.*
- See also SCIENCE and SOCIAL SCIENCE lists: *Organizing, Processing Data.*

Analyzing and Interpreting Data

- Students determine from their graphs which brand costs the least, which brand is least greasy.
- Students calculate a preference rating for each brand based on results of the taste test.
- Students consider cost vs. quality in determining best brand; e.g., second-best brand in terms of quality may cost much less.
- See also MATHEMATICS list: *Comparing; Statistical Analysis; Opinion Surveys/Sampling Techniques; Graphing; Variable Rates of Change/Maximum and Minimum Values.*
- See also SCIENCE and SOCIAL SCIENCE lists: *Analyzing/Interpreting Data.*

Predicting, Formulating Hypotheses, Suggesting Possible Solutions Based on Data Collected

- Students hypothesize that the results of their taste test reflect the preferences of all students.
- Students decide to serve brand X at their party based on their data on cost, greasiness, and preferences.
- See also SCIENCE list: *Inferring/Predicting/Formulating, Testing Hypotheses/Modeling.*
- See also SOCIAL SCIENCE list: *Inferring/Predicting/Formulating, Testing Hypotheses.*

Evaluating Proposed Solutions in Terms of Practicality, Social Values, Efficacy, Aesthetic Values

- Students decide that their choice of potato chips is the best in terms of the money they have.

Trying Out Various Solutions and Evaluating the Results, Testing Hypotheses	• Students repeat the taste test with another sample of students. • Students conduct a survey after the party to determine how well the potato chips were liked. • See also SCIENCE list: *Inferring/Predicting/Formulating, Testing Hypotheses/Modeling.* • See also SOCIAL SCIENCE list: *Inferring/Predicting/Formulating, Testing Hypotheses.*
Communicating and Displaying Data or Information	• Groups report to the class on their findings. • Students draw graphs to communicate their data. • See also MATHEMATICS list: *Graphing; Scaling.* • See also SCIENCE and SOCIAL SCIENCE lists: *Communicating, Displaying Data.* • See also LANGUAGE ARTS list.
Working to Implement Solution(s) Chosen by the Class	• Students serve brand X at their party. • Students present their findings to parents and to school dietitian.
Making Generalizations That Might Hold True Under Similar Circumstances; Applying Problem-Solving Process to Other Real Problems	• Students apply skills acquired in testing materials to similar problems arising in Manufacturing, School Supplies, and other USMES units. • Students apply scientific inquiry process learned to other real problems. • See also SCIENCE list: *Generalizing/Applying Process to New Problems.* • See also SOCIAL SCIENCE list: *Generalizing/Applying Process to Daily Life.*

ACTIVITIES IN CONSUMER RESEARCH UTILIZING MATHEMATICS

Basic Skills

Classifying/Categorizing	• Classifying test results or results from opinion surveys. • See also SCIENCE list: *Observing/Describing; Classifying.* • See also SOCIAL SCIENCE list: *Observing/Describing/Classifying.*
Counting	• Counting votes for products to test. • Counting survey or questionnaire data on preferences. • Counting number of seconds, number of centimeters, number of items in a package. • Counting to figure weight, area, volume measurements. • Counting by sets to find scale for graph axes.
Computation Using Operations: Addition/Subtraction	• Adding one- or two-digit whole numbers to find total tally of preferences or total measurement. • Adding seconds and minutes when timing the length of an experiment. • Subtracting to find difference between predicted and actual measurements or counts. • Subtracting one- or two-digit whole numbers to find range of measurements or counts. • Subtracting one- or two-digit whole numbers to find differences among brands tested.
Computation Using Operations: Multiplication/Division	• Multiplying whole numbers to find total tally of votes. • Multiplying and dividing whole numbers to find preference rating from a survey. • Dividing to find average preference rating or average measurement. • Dividing to calculate a unit measure such as weight per item, weight per unit volume or area. • Dividing and multiplying to find percentages.
Computation Using Operations: Fractions/Ratios/Percentages	• Using mixed numbers to perform calculations needed to find unit measures or averages. • Changing fractions to higher or lower terms to perform operations.

Computation Using Operations: Fractions/Ratios/Percentages (cont.)	• Using ratios and fractions to convert from ounces to pounds, quarts to fluid ounces, etc. • Using fractions in measurement, graphing, comparing measurements. • Using slope diagrams to compare ratios, as weight per unit, number per package. • Calculating percentage of students that prefer a certain brand, percentage of tests that have a certain result.
Computation Using Operations: Business and Consumer Mathematics/ Money and Finance	• Adding and subtracting dollars and cents to perform cost analysis. • Multiplying to find total cost of materials needed for testing. • Dividing to find price per unit of different brands of the same product. • Using slope diagrams to compare cost per unit of different brands. • Comparing prices when shopping for different brands, different sizes. • Comparing costs of materials for testing vs. need for materials vs. money available.
Measuring	• Using arbitrary units (length of a string) to measure distance for a particular test. • Using standard units to measure length, weight, volume in tests. • Using different measuring tools to measure length (stretch), weight (strength), area, etc. • See also SCIENCE list: *Measuring/Collecting, Recording Data.* • See also SOCIAL SCIENCE list: *Collecting, Recording Data, Measuring.*
Comparing	• Using the concept of *greater than* or *less than* in making comparisons on test results. • Comparing test results on different brands. • Comparing estimated test results with actual test results. • Making graphic comparisons of unit measures (number per package, weight per item). • Comparing costs of different brands. • See also SCIENCE list: *Analyzing, Interpreting Data.* • See also SOCIAL SCIENCE list: *Analyzing, Interpreting Data.*

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Estimating/Approximating/Rounding Off	• Estimating possible error in tests of brands. • Estimating possible error when collecting data from a sample of people or items. • Estimating results of surveys on preferences. • Estimating numbers of items, measurements, costs. • Determining when a measurement of strength, absorbency, greasiness, etc., is accurate enough to compare brands. • Using approximation in constructing test equipment. • Rounding off data according to accuracy required.
Organizing Data	• Tallying votes to determine which products to test. • Tallying survey data, questionnaire data on preferences for different brands. • Tallying on bar graphs, or histograms (if tests are repeated). • Tallying on confusion matrix. • Ordering numbers on graph axes. • Ordering units of measure in terms of size such as ounces, pints, quarts, gallons, or milliliters, liters. • See also SCIENCE list: *Organizing, Processing Data.* • See also SOCIAL SCIENCE list: *Organizing, Processing Data.*
Statistical Analysis	• Taking repeated measurements and finding the median measurement. • Finding the quartiles and interquartile range of repeated measurements. • Finding statistical probability of a certain measurement occurring. • Assessing accuracy of an estimate based on a sample of tests or sample of people. • Comparing medians and interquartile ranges of data gathered on different brands. • Interpreting histograms of repeated measurements on one brand, interpreting q-q graphs of repeated measurements on two brands. • See also SCIENCE list: *Analyzing, Interpreting Data.* • See also SOCIAL SCIENCE list: *Analyzing, Interpreting Data.*
Opinion Surveys/Sampling Techniques	• Conducting opinion surveys on preferences for different brands; defining data collection methods. • Defining makeup and size of sample.

Opinion Surveys/Sampling Techniques (cont.)

- Devising method to obtain quantitative information (preference rating) from opinion surveys.
- Evaluating survey: questions asked, size and makeup of sample.
- Evaluating accuracy of survey results.
- See also SCIENCE list: *Analyzing, Interpreting Data.*
- See also SOCIAL SCIENCE list: *Analyzing, Interpreting Data.*

Graphing

- Using alternative methods of displaying data, e.g., charts, graphs.
- Making a graph form--dividing axes into parts, deciding on scale, labeling axes.
- Putting data on graph forms.
- Obtaining information from graphs.
  - Bar graph--test results vs. brands tested.
  - Histogram--number of batteries (of one brand) vs. lifetimes of batteries.
  - Line chart--preference ratings of different brands obtained from two sources, e.g., primary grades and intermediate grades.
  - Conversion graph--ounces vs. grams.
  - Slope diagram--cost vs. quantity of different brands, or different sizes.
  - Scatter graph--strength vs. stretchability of each of several brands of plastic wraps.
  - Cumulative distribution graph--number of batteries vs. lifetime of certain length or less.
  - Line graph--amount of water absorbed by a paper towel vs. length of test.
- See also SCIENCE list: *Communicating, Displaying Data.*
- See also SOCIAL SCIENCE list: *Communicating, Displaying Data.*

Spatial Visualization/Geometry

- Using geometric figures to understand and utilize relationships of area and volume, area and perimeter.
- Using standard mensurational formulas, e.g., A = L x W (Area = Length x Width).
- Devising other methods to measure or compare length, area, volume.
- Designing and constructing test equipment.
- Making flow diagram of test procedures.

Areas of Study	
Numeration Systems	• Using decimal system in measuring length (cm, mm), weight (g), volume (ml) in tests. • Using fractions in measuring length (parts of inches), weight (parts of pounds), volume (parts of cups). • Using decimal system in calculating costs of brands.
Number Systems and Properties	• See *Computation Using Operations*.
Denominate Numbers/Dimensions	• See *Measuring*.
Scaling	• Recognizing relationships of various units of measure, e.g., inches, feet, yards or centimeters, meter, kilometer.
Symmetry/Similarity/Congruence	• See *Spatial Visualization/Geometry*.
Accuracy/Measurement Error/ Estimation/Approximation	• See *Measuring* and *Estimating/Approximating/Rounding Off*.
Statistics/Random Processes/ Probability	• See *Statistical Analysis*.
Graphing/Functions	• See *Graphing*.
Fraction/Ratio	• See *Computation Using Operations: Fractions/Ratios/ Percentages*.
Maximum and Minimum Values	• Determining the best test result. • Maximizing quality while minimizing cost to determine best brand. • Using slope diagram to determine minimum cost per unit weight.
Equivalence/Inequality/Equations	• See *Comparing* and *Computation Using Operations*.

Money/Finance	• See *Computation Using Operations: Business and Consumer Mathematics/Money and Finance.*
Set Theory	• See *Classifying/Categorizing.*

Process

Observing/Describing	• Observing differences in brands of a product while conducting tests (e.g., Brand A absorbs the most water). • Describing the characteristics of a product (e.g., paper towels should be soft, absorbent and strong). • See also SOCIAL SCIENCE list: *Observing/Describing/Classifying.*
Classifying	• Classifying product brands according to various characteristics, e.g., strength, absorbency, softness, scrubbing ability of paper towels. • Determining which characteristics of a product can be measured by different tests (e.g., strength and scrubbing ability are measured by one test; absorbency and softness are measured by another). • Determining which characteristics of a product are measured by the same test (e.g., both strength and stretchability of plastic wraps are measured by attaching weights to a piece). • Classifying ingredients in a product according to natural and artificial. • See also MATHEMATICS list: *Classifying/Categorizing.* • See also SOCIAL SCIENCE list: *Observing/Describing/Classifying.*
Identifying Variables	• Identifying variables in an experiment, e.g., number (or size) of popcorn kernels, size of popped popcorn, number of unpopped kernels, number of burned kernels as variables to be measured in an experiment on popcorn. • Identifying amount of heat and cooking oil as variables to be controlled in an experiment. • See also SOCIAL SCIENCE list: *Identifying Problems/Variables.*
Defining Variables Operationally	• Defining amount of heat as the amount produced in ten minutes by a certain electric popper after a five-minute preheating period. • Defining amount of cooking oil as 1/4 cup of a certain brand of oil.

Defining Variables Operationally (cont.)	• Defining size of popcorn kernels as the median size found in a sample of ten kernels picked randomly. • See also SOCIAL SCIENCE list: *Identifying Problems/ Variables.*
Manipulating, Controlling Variables/Experimenting	• Using the same popcorn popper each time. • Popping the popcorn for the same length of time for each brand. • Using the same amount of cooking oil each time. • Picking the sample of kernels the same way each time. • See also SOCIAL SCIENCE list: *Manipulating, Controlling Variables/Experimenting.*
Designing and Constructing Measuring Devices and Equipment	• Constructing gadgets that will help control variables such as the holder for pens that will exert the same amount of pressure over a long period of time. • Constructing gadgets that will help test for specific characteristics such as holders that will apply weight evenly to paper towels.
Inferring/Predicting/Formulating, Testing Hypotheses/Modeling	• Inferring from test data that a certain brand is better than other brands. • Predicting that a certain brand will have a certain test result. • Hypothesizing that a change in one variable will produce a change in the results, e.g., popping popcorn longer will produce more popped kernels. • Testing hypothesis by counting number of unpopped kernels before and after change. • See also SOCIAL SCIENCE list: *Inferring/Predicting/ Formulating, Testing Hypotheses.*
Measuring/Collecting, Recording Data	• Reading measuring devices accurately--meter sticks, equal arm balances, spring balances, thermometers, volume measures, stopwatches. • Designing methods to measure specific characteristics of products, such as greasiness, sogginess, absorbency, cleaning ability. • Recording data in chart form. • See also MATHEMATICS list: *Measuring.* • See also SOCIAL SCIENCE list: *Collecting, Recording Data/ Measuring.*

Organizing, Processing Data

- Ordering repeated measurements from smallest to largest.
- Organizing data according to conditions present in experiment.
- See also MATHEMATICS list: *Organizing Data.*
- See also SOCIAL SCIENCE list: *Organizing, Processing Data.*

Analyzing, Interpreting Data

- Calculating the average of repeated measurements.
- Interpreting graphs to determine which brand costs the least, which brand has the best test result.
- Determining best brand in terms of cost vs. quality.
- See also MATHEMATICS list: *Comparing; Statistical Analysis; Opinion Surveys/Sampling Techniques; Graphing; Maximum and Minimum Values.*

Communicating, Displaying Data

- Drawing graphs to communicate data.
- See also MATHEMATICS list: *Graphing.*
- See also SOCIAL SCIENCE list: *Communicating, Displaying Data.*
- See also LANGUAGE ARTS list.

Generalizing/Applying Process to New Problems

- Applying skills acquired in testing materials to similar problems arising in other USMES units.
- Applying scientific inquiry process learned to other real problems.
- See also SOCIAL SCIENCE list: *Generalizing/Applying Process to Daily Life.*

Areas of Study

Measurement

- Timing the length of a test using a stopwatch.
- Using standard and non-standard units to measure--
  a. length, e.g., amount of stretch of plastic wraps, length (and width) of pencil marks
  b. weight, e.g., amount of weight needed to tear paper towels
  c. volume, e.g., amount of water used in test for paper towel absorbency, cereal sogginess
  d. area, e.g., area of grease spot from potato chips
  e. temperature, e.g., temperature at which candy melts
- See also *Designing and Constructing Measuring Devices and Equipment; Measuring/Collecting, Recording Data.*

Measurement (cont.)	• See also MATHEMATICS list: *Measuring*.
Motion	
Speed/Velocity	• Observing that the speed of an object affects the amount of impact the object has on another object. • Observing that objects at rest do not move until a force is exerted on them. • Observing that motion of an object is decreased or increased if a force is applied to it. • Observing that electrically-run machines (saber saws, electric drills) are faster than hand machines.
Force	• Observing that force must be applied to hammer nails into wood. • Observing that machines multiply the force that is exerted, e.g., a hammer multiplies the force exerted by a person.
Weight	• Weighing objects to compare weights of different brands. • Weighing objects to determine equal weights of different brands to use in experiments. • Observing that weight applies force because of the gravitational pull on objects. • Observing that weight (force) is centered at a certain spot in an object. • Observing that strength can be measured as resistance to another force/weight.
Friction	• Observing that rough surfaces resist motion more than smooth surfaces, e.g., in scrubbing tests on paper towels.
Mechanical Work and Energy	• Noting that work is done and energy expended when nails are hammered into wood. • Observing that electrical energy is converted into the mechanical energy of saber saws, electric drills. • Observing that rubbing surfaces together generates heat as mechanical energy is transformed into heat energy. • See also *Motion* and *Force*.

Solids, Liquids, and Gases

States of Matter

- Observing that products are solids, liquids, or gases.
- Observing that glue is available in liquid or solid form with different properties.
- Observing that heat from a glue gun turns a cool stick of glue into hot liquid glue.

Properties of Matter

- Observing that brands of products have different properties, e.g., crispness, flavor, color, taste, absorbency, strength, greasiness, odor.
- Observing that different construction materials, such as lumber and Tri-Wall, have different properties that make them useful for different tasks.

Electricity

- Observing that different brands of batteries wear out in different lengths of time.
- Designing an experiment to test lifetime of different brands of batteries.
- Using batteries in circuits to light bulbs, energize electromagnets, run motors.
- Observing that electricity can be transformed to light energy (lighting bulbs), mechanical energy (running motors), heat energy (running glue gun), chemical energy (charging batteries).
- Observing that lights go on and off when switches are closed and opened.
- Observing that electricity does not flow through insulation or wires.
- Observing that a bad contact in a circuit reduces the flow of electricity--batteries wear out faster.

Heat

- Observing that some machines (glue gun, popcorn popper) generate heat when turned on as electrical energy is transformed into heat energy.
- Observing that the temperature of some products affects their taste.
- Controlling the amount of heat in experiments on brands of products.

Light	• Observing that the chemical energy of batteries can be transformed into light energy. • Observing that different products and brands come in different colors. (The color of an object depends on specific colors (frequencies) in the spectrum that it reflects.) • Observing that dark-colored objects become warmer when placed in the sun than light-colored objects. (Dark colors absorb more light energy that changes to heat energy.)
Sound	• Observing that some of the electrical energy supplied to power tools is transformed into sound energy (noise).
Nutrition/Growth	• Observing that soil, water, light, freshness of seeds and fertilizer are variables to consider when testing different soils, different lights, different fertilizers, or the growth rate of different brands of seeds.

ACTIVITIES IN CONSUMER RESEARCH UTILIZING SOCIAL SCIENCE

Process

Observing/Describing/Classifying	• Describing the various uses of a product, e.g., paper towels are used to absorb liquids and scrub surfaces. • Classifying groups of people according to similarities in order to choose a stratified sample for an opinion survey. • See also MATHEMATICS list: *Classifying/Categorizing.* • See also SCIENCE list: *Observing/Describing; Classifying.*
Identifying Problems, Variables	• Identifying problems in choosing the best brand to buy, the best place to shop. • Identifying variables that affect taste tests, e.g., order in which brands are tasted, retention of taste from previous brand. • Identifying variables that affect the results of an opinion survey, e.g., time of day, age of people, habits of people. • See also SCIENCE list: *Identifying Variables.*
Manipulating, Controlling Variables/ Experimenting	• Designing an opinion survey using a stratified sample and controlling other variables. • Designing taste tests that control the variables. • See also SCIENCE list: *Manipulating, Controlling Variables/Experimenting.*
Inferring/Predicting/Formulating, Testing Hypotheses	• Inferring that the results of a taste test or opinion survey on a sample of students reflect the tastes and opinions of all students. • Hypothesizing that telling others about their findings will help them choose the best brand to buy; conducting survey to find out if information is helpful. • See also SCIENCE list: *Inferring/Predicting/Formulating, Testing Hypotheses.*
Collecting, Recording Data/Measuring	• Recording results of taste tests, opinion surveys on preferences for different brands. • See also MATHEMATICS list: *Counting; Measuring.* • See also SCIENCE list: *Measuring/Collecting, Recording Data.*

Organizing, Processing Data	• Ordering results of taste tests and surveys from most popular to least popular. • See also MATHEMATICS list: *Organizing Data.* • See also SCIENCE list: *Organizing, Processing Data.*
Analyzing, Interpreting Data	• Comparing qualitative data on survey results. • Comparing qualitative data (survey results) with quantitative data (taste test results). • Comparing data obtained from different groups of people or from samples of different size. • Evaluating the way the opinion survey was administered, the size and makeup of the sample. • Assessing the accuracy of the results of taste tests, opinion surveys. • See also MATHEMATICS list: *Comparing; Statistical Analysis; Opinion Surveys/Sampling Techniques; Graphing; Maximum and Minimum Values.* • See also SCIENCE list: *Analyzing, Interpreting Data.*
Communicating, Displaying Data	• Making charts or graphs that can be easily understood and have maximum impact on intended audience. • See also MATHEMATICS list: *Graphing.* • See also SCIENCE list: *Communicating, Displaying Data.* • See also LANGUAGE ARTS list.
Generalizing/Applying Process to Daily Life	• Using one's knowledge of comparative shopping and consumer product testing in formulating buying habits. • Using one's knowledge of opinion surveys on other surveys. • Applying scientific inquiry skills learned to problems in personal and community life. • See also SCIENCE list: *Generalizing/Applying Process to New Problems.*

Attitudes/Values

Accepting Responsibility for Actions and Results	• Making sure that various tasks (e.g., collecting materials, collecting data) are done. • Arranging schedules with other classes for convenient times for taste tests or opinion surveys. • Being responsibile for actions during trips to stores, visits to other classes, etc.

Developing Interest and Involvement in Human Affairs	• Seeking ways to inform others about findings on best brands to buy.
Recognizing the Importance of Individual and Group Contributions to Society	• Recognizing that their findings may help others to make better purchases.
Developing Inquisitiveness, Self-Reliance, and Initiative	• Conducting group sessions with help from the teacher. • Dealing with various merchants in obtaining products to test, materials for testing apparatus. • Designing special test equipment for a specific purpose. • Finding own solutions to problems encountered. • Finding different ways to obtain and convey information, e.g., writing letters, telephoning.
Recognizing the Values of Cooperation, Group Work, and Division of Labor	• Finding that work on testing a product progresses more rapidly when different tests are done by different groups. • Finding that work proceeds smoothly when everyone cooperates and when data is kept in one place.
Understanding Modes of Inquiry Used in the Sciences, Appreciating Their Power and Precision	• Identifying important characteristics of products to test. • Recognizing the importance of obtaining information from users of products. • Identifying the need for quantitative data in order to make comparisons. • Identifying steps to take in the process of testing. • Using data and graphs to tell others about their findings. • See also MATHEMATICS and SCIENCE lists.
Respecting the Views, Thoughts, and Feelings of Others	• Considering all suggestions from members of group and assessing their merits. • Obtaining information from others about preferences for brands and specific characteristics of products. • Recognizing that people's opinions vary.
Being Open to New Ideas and Information	• Considering other ways of doing various tasks. • Asking other members of the class for ideas and suggestions. • Shopping at different stores for products.

Learning the Importance and Influence of Values in Decision Making	• Realizing that cost alone is not sufficient in choosing a brand to buy; people's tastes and need for product must also be considered. • Recognizing that preferences for particular brands or characteristics of brands reflect individual values.
Areas of Study	
Anthropology	• Observing differences in food preference related to cultural and geographic background.
Economics	• Using economic terms and concepts, e.g., cost, profit, retail and wholesale price when buying products to test. • Analyzing variables affecting consumer purchases. • Investigating the cost of various brands of products. • Gaining experience in comparative shopping for products and materials to use in testing. • Assessing costs of equipment vs. use of equipment. • Assessing preferences, characteristics of possible consumers through surveys, questionnaires, tests. • Gaining experience in finance: sources, uses, and limitations of funds for purchasing products and materials.
Geography/Physical Environment	• Investigating differences in costs in different stores due to differences in location.
Political Science/Government Systems	• Investigating administration of taxes, controls on products. • Asking school authorities for permission to circulate findings on brands of products or to promote change in use of brands by school.
Recent Local History	• Investigating changes in prices of brands, changes in locations of stores.

Social Psychology/Individual and Group Behavior	• Recognizing and using different ways of approaching different groups; e.g., using a different approach for fellow students from that for a school board, finding "best" ways to approach the principal about approval for circulating findings. • Recognizing the need for leadership within small and large groups; recognizing differing capacities of individuals for various roles within groups. • Analyzing the effects of a small group making decisions for a larger group.
Sociology/Social Systems	• Devising a system of working cooperatively in small and large groups. • Considering the integral, related nature of a community as a factor in the problem of location of stores. • Investigating problems and suggesting changes that affect not only themselves, but society (other students in the school, parents, people in community). • Working within established social systems to promote changes in use of certain products. • Experiencing and understanding differences in social systems in different social groups (children, adults, women, men, homemakers).

ACTIVITIES IN CONSUMER RESEARCH UTILIZING LANGUAGE ARTS

Basic Skills

Reading: Literal Comprehension--Decoding Words, Sentences, and Paragraphs	• Decoding words and sentences when reading ingredients on packages, drafts of letters and surveys, yellow pages of telephone book, reports on work.
Reading: Critical Reading--Comprehending Meanings, Interpretation	• Reading and evaluating drafts of letters, surveys, reports. • Understanding what is read about fair trade regulations, consumer protection, fair advertising practices.
Oral Language: Speaking	• Reporting group activities to class; responding to criticisms of activities. • Offering ideas, suggestions, and criticisms during small group work and during class discussions on problems and proposed solutions. • Preparing and giving effective oral presentations of survey questions, methods, findings, and suggested solutions. • Using the telephone properly and effectively. • Using rules of grammar in speaking.
Oral Language: Listening	• Listening to group reports. • Conducting taste test survey. • Listening during talk by expert on consumer education. • Investigating effect of different forms of communication on people.
Oral Language: Memorizing	• Memorizing portions of oral presentations.
Written Language: Spelling	• Using correct spelling in writing.
Written Language: Grammar--Punctuation, Syntax, Usage	• Using rules of grammar in writing.

Written Language: Composition	• Writing to communicate effectively:
	  • writing opinion surveys, devising questions to elicit desired information; judging whether a question is clear.
	  • writing letters and reports to manufacturers, retailers, consumer protection groups, federal agencies, etc., to advise of findings.
	  • preparing booklets or posters to make presentation of class investigations, procedures, and test results.

Study Skills: Outlining/Organizing	• Taking notes. • Developing opinion survey; ordering questions. • Planning presentations, data collection schemes, etc. • Planning and preparing drafts of letters, reports for critical review by the class before final copy is written. • Organizing ideas, facts, data for inclusion in letters, reports, presentations, etc.
Study Skills: Using References and Resources	• Using the library to research information on fair trade laws, consumer protection, fair advertising. • Finding an expert on consumer education and inviting him or her to speak to the class and answer questions. • Using "How To" Cards for information on measuring, graphing skills.
Attitudes/Values	
Appreciating the Value of Expressing Ideas Through Speaking and Writing	• Finding that a written letter or phone conversation evokes a response from people, e.g., the principal, parents, city officials. • Finding that many people can be informed of test results on consumer products through a newsletter.
Appreciating the Value of Written Resources	• Finding that desired information can be found in written resources, e.g., newspapers and magazines, telephone books, reports, etc.

Developing an Interest in Reading and Writing	• Seeking out written resources that will help in solving problems. • Reading with interest articles, reports, advertisements.
Making Judgments Concerning What is Read	• Deciding how reliable information is: what the basis is for facts stated. • Evaluating consumer protection plans.
Appreciating the Value of Different Forms of Writing, Different Forms of Communication	• Finding that how information can be best conveyed is determined in part by the audience to whom it is directed. • Finding that certain data or information can be best conveyed by writing it down, preparing graphs or charts, etc. • Finding that certain data or information should be written down so that it can be referred to at a later time. • Finding that spoken instructions are sometimes better than written instructions, and vice versa.